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THE VALUE OF THE VARIOUS KIDNEY FUNCTION TESTS IN THE DIFFERENTIATION OF THE TOXEMIAS OF PREGNANCY

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THE majority of patients suffering from a toxemia of pregnancy fall into one of the three types known as nephritic, preeclamptic, and low reserve kidney. It is in the differentiation between these types that a great deal of confusion still exists. In the nephritic group fall all cases with definite kidney disease; in the preeclamptic group those showing the signs and symptoms which may eventuate in eclampsia; and in the low reserve kidney group those manifesting late in pregnancy signs of inadequate renal function which disappear completely within the month following delivery. One of us has fully defined these groups in earlier publications.¹

Unfortunately, in about one-tenth of our patients the differential diagnosis between these three types of toxemia of pregnancy is quite difficult. In a recent follow-up study in this Clinic, Peckham and Stout² found that by following our criteria for these groups, 11 per cent proved to have been wrongly diagnosed at the time of discharge from the hospital. A rapidly developing marked preeclampsia, a pronounced chronic nephritis, or a mild low reserve kidney, responding rapidly to treatment, are readily recognizable, but it is not an easy task to group correctly the borderline case, which may be a pronounced low reserve kidney, a very mild or early nephritis, or a slowly developing preeclampsia.

It is because of this difficulty in differentiation in a certain percentage of cases that we undertook to carry out a systematic study of the various kidney function tests which seemed worthy of investigation. During the past two years we have conducted such tests on 65 patients, including 19

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normal pregnancies. In the majority of our cases, all the renal function tests studied were made on each patient, and in many instances the various tests were repeated on the same patient.

TESTS EMPLOYED

The following kidney function tests were used: (1) Mosenthal concentration test; (2) phenolsulphonephthalein test; (3) urea clearance test; (4) urea concentration factor; (5) diastase test; (6) creatinine test; (7) guanidine test; (8) thiosulphate test.

The Mosenthal concentration test was carried out strictly according to the directions of the author,³ and in our Tables I to III are reported the variations in specific gravity of the various urine specimens, the night urine volume in cubic centimeters, the urine nitrogen, and the urine chlorides in percentages.

The phenolsulphonephthalein test was performed by obtaining first and second hour urine specimens, as well as by the Shaw modification⁴ involving half-hour specimens. In our tables the percentage of dye excreted is recorded for the four half-hour periods under four columns labelled 1, 2, 3, 4, respectively, and the total excretion is given in the last column.

Urea clearances were determined according to the method described by Möller, McIntosh and Van Slyke.⁵ In some cases urea was given by mouth, while in others the patient had breakfast preceding the test. The standard as well as the maximum clearances are reported as percentages of the mean normal, and given in two columns for first and second hours, with the averages in the final column.

The urea concentration factor was determined according to the technic described by Rabinowitch and Patch,⁶ and is written in a separate column in the tables. The factor was calculated as follows:

$$\frac{\text{Urine urea concentration (second hour)}}{\frac{\text{Blood urea concentration before and blood urea after}}{2}}$$

The diastase test was performed according to the method of MacLean,⁷ and represents the amylose content of the urine.

The creatinine and guanidine tests were carried out according to the instructions of Major.⁸ The results for these tests are not shown in the tables but are graphically demonstrated in Figs. 2 and 3.

The thiosulphate test used is that of Nyiri.⁹ The sodium benzoate test as suggested by Kingsbury and Swanson,¹⁰ as well as the Andrew's diazo test¹¹ were not studied as the determination of hippuric acid in the former is somewhat complicated for a routine clinical procedure, while the color reaction in the latter is not very sharp.

RESULTS

Nineteen cases of normal pregnancy were studied and the results for the Mosenthal, phthalein, urea clearance, urea concentration factor and

TABLE I. NORMAL PREGNANCY NEAR TERM

CASE	MOSETHAL TEST				PHTHALEIN TEST					UREA CLEARANCE			UREA CON. FACTOR	DIASTASE TEST
	SP. GR. VAR.	VOL. IN C.C.	N. PER CENT	CL. PER CENT	1	2	3	4	TOTAL	1	2	AVER.		
1	12	240	1.04	0.79		56.1		10.7	66.8				96.2	6.6
2	3	760	0.53	0.82									55.1	
3	12	780	0.42	0.72									39.5	
4					52.0	12.0	8.2	6.9	89.1				22.3	6.6
5	17	250			62.7	11.5	8.1						38.2	
6													40.9	
7	10	235	0.98	1.57		75.0		5.0	80.0					3.3
8													38.6	
9	7	270	0.82	1.52									41.4	
10	9	850	0.61	1.52		61.0			61 +				32.9	
11	12	370	1.41	1.38	51.3	19.6	6.1	1.8	78.8				27.2	
12	12	430	1.07	0.79		28.5		22.7	51.2					
13	9	640	0.92	1.59		46.6		16.5	63.1					
14	8					67.3		24.0	91.3					
15	19	550	0.47	0.85	45.6	19.5	7.0	3.9	76.0	88.4	116	102.2	68.4	
16					47.6	9.7	5.9	3.1	66.3	84.0	103	94.0	54.2	
17										59.0	124	92		
18										116.0	107	110		
19														5.5
Aver.	10.8	488.6	0.83	1.15					67.4			99.5	46.2	
Normal nonpreg-nant	9 or over	Under 750	1 per cent or higher	1 per cent or higher					60-85			80-120	40-50	6 or over

diastase tests, are recorded in Table I. At the bottom of this table are also given the normal values, as usually stated, in order to permit comparison with our findings in normal pregnancy. It will be seen that although the averages for normal pregnancy agree fairly well with the

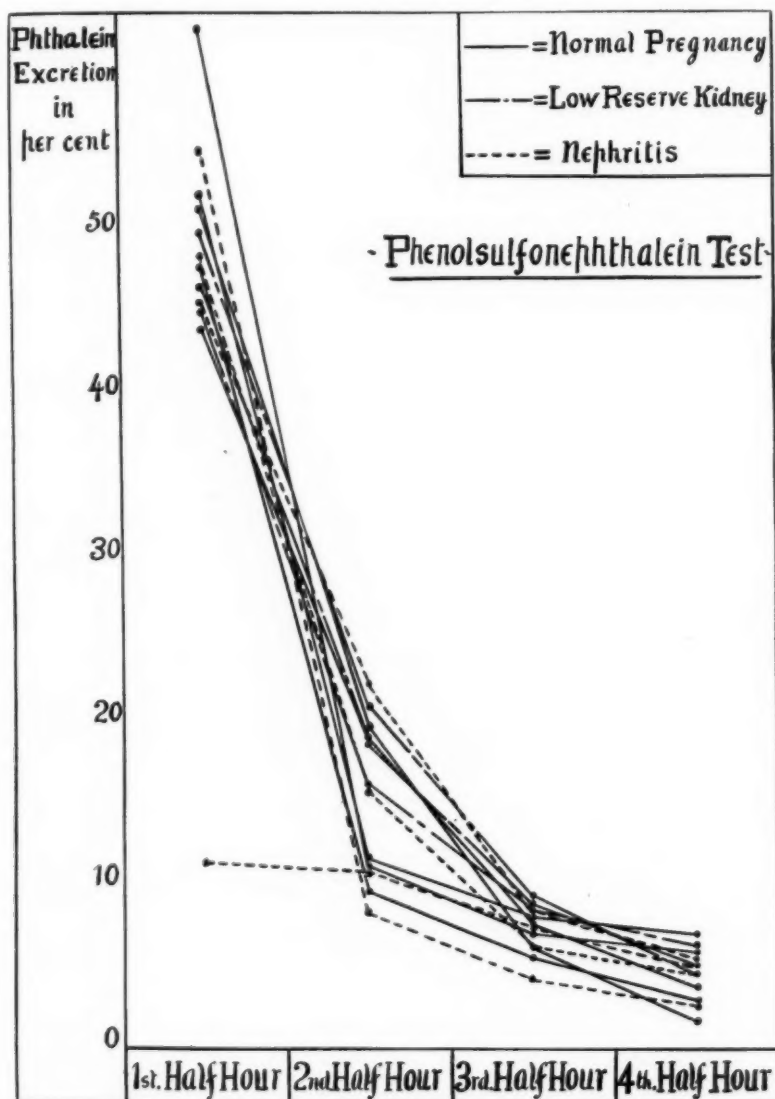


Fig. 1

accepted normal figures, there are wide variations in individual cases for all these tests with the exception of the phenolsulphonephthalein and urea clearance tests.

In Tables II and III we record the values obtained in patients suffering from low reserve kidney and nephritis, respectively. From a study of

TABLE II. LOW RESERVE KIDNEY

CASE	MOSETHAL TEST				PHTHALEIN TEST					UREA CLEARANCE			UREA CON. FACTOR	DIASTASE TEST
	SP. GR. VAR.	VOL. IN C.C.	N. PER CENT	CL. PER CENT	1	2	3	4	TOTAL	1	2	AVER.		
20	9	330	0.61	1.2	46.5	19.4	8.2	4.4	78.5				4.4	
21	20					65.0		15.0	80.0					
22	6	270	0.41	0.25	45.4	16.2	8.0	6.3	75.7	146	98.0	122.0	26.2	
23	11	570	0.77	0.63	50.0	20.4	9.0	4.9	84.3	114	114.0	114.0	53.1	
24	5	73	1.51	3.97		69.4		9.8	79.2				40.5	6.6
25	5	700	0.50	0.77		47.0		15.0	62.0				13.3	2.0
26	8	730	0.45	1.15									54.6	
27						50.0		10.0	60.0	45.3	77.4	62.0		
Aver.	9.1	445	0.71	1.3					74.2			99.3	38.6	

TABLE III. NEPHRITIS

CASE	MOSETHAL TEST				PHTHALEIN TEST				UREA CLEARANCE			UREA CON. FACTOR	DIASTASE TEST
	SP. GR. VAR.	VOL. IN C.C.	N. PER CENT	CL. PER CENT	1	2	3	4	TOTAL	1	2	AVER.	
28	12	370	0.76	0.78	46.4	22.5	9.8	5.7	84.4				34.8
29	10	440	1.11	0.43									25.7
30	15												
31					11.5	11.3	8.2	5.2	36.2				
32	9	415			48.7	16.1	9.5	5.6	79.9	47.4	88.9	68.1	67.9
33	11	340	0.94	0.79		35.0		10.0	45.0				
34					17.0					138.	1.1	69.5	
35	4					25.0		10.0	35.0			75.0	
36	6					40.0		10.0	50.0			80.0	
37	5	340	0.91	0.68		35.0		10.0	45.0				
38										56.	67.5	61.7	45.2
39										74.1	81.0	77.5	
40										44.4	66.6	55.5	
41										99.2	99.3	94.2	
42	5	590	0.44	0.68	56.6	9.4	4.8	3.1	73.9	56.0	63.3	60.0	3.3
Aver.	8.5	416	0.83	0.73					56.1			71.2	40.7

these tables it will be noted that the Mosenthal test was not of definite value in differentiating between these types of toxemia, the average specific gravity variation for low reserve kidney being 9.1 and for nephritis 8.5, values that are both just below the normal. The same may be said for the urea concentration factor and the diastase test. The phthalein excretion test is of value only in cases of marked kidney impairment but is of little help in the milder cases. The urea clearance appears to be of definite value. It will be seen that while the normal nonpregnant finding

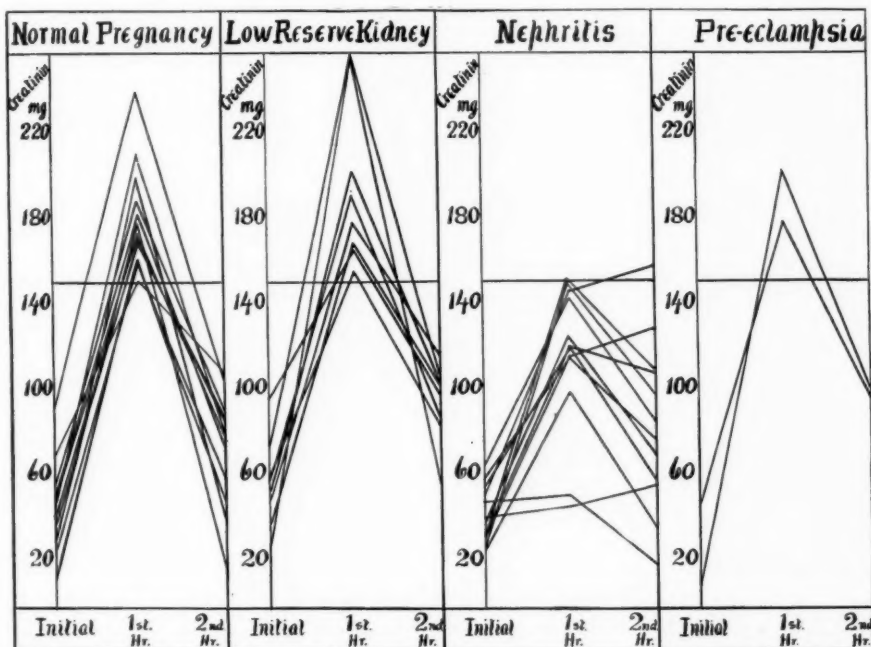


Fig. 2.—Creatinine test.

is between 80 and 120 per cent, it falls within that range in our normal pregnant women and in cases of low reserve kidney and preeclampsia, while the nephritic patients show clearances definitely below the lower limit of normal.

The results of the creatinine and guanidine tests revealed outstanding differences between nephritis and the other two groups, low reserve kidney and preeclampsia. These differences are clearly shown in Figs. 2 and 3. All our nephritic patients showed an excretion below the lower limit of normal.

The results with the thiosulphate tests of Nyiri were disappointing. Applied to a case of normal pregnancy we found 19.9 per cent excreted in the urine, while the author gives the normal range of from 30 to 40 per cent, and for kidney disease values ranging between 1 and 23 per cent. Further application of this test in five patients corroborated the view that it is not of great value, in so far as we have studied it, in the toxemias of pregnancy.

COMMENT

The phenolsulphonephthalein test, even when carried out in half-hour periods, is not of value in the differentiation between mild or incipient cases of renal disease and the other toxemias of pregnancy. This is well

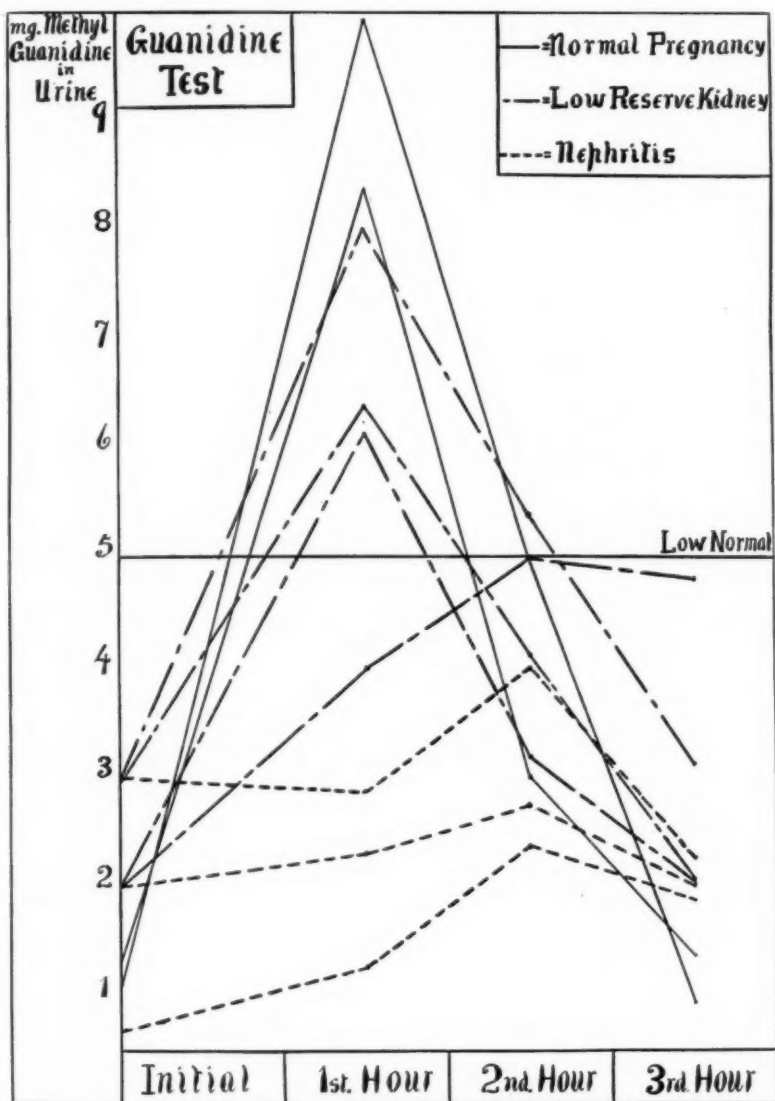


Fig. 3

demonstrated in Fig. 1. The same may be said of the Mosenthal, diastase and thiosulphate tests.

The urea concentration tests are of value, and of these the clearance test devised by Van Slyke and his associates promises to be the most helpful. It certainly seems that this test will aid us in the early recognition

of mild or beginning nephritis. Values definitely below 80 per cent of the mean normal should be regarded as of serious import. We strongly recommend this test in borderline cases where a differential diagnosis is difficult. The technic for determining the urea clearance as a measure of renal efficiency is carried out as follows:

The patient must remain quietly in bed during the two-hour test period. The preferable period for running the test is between breakfast

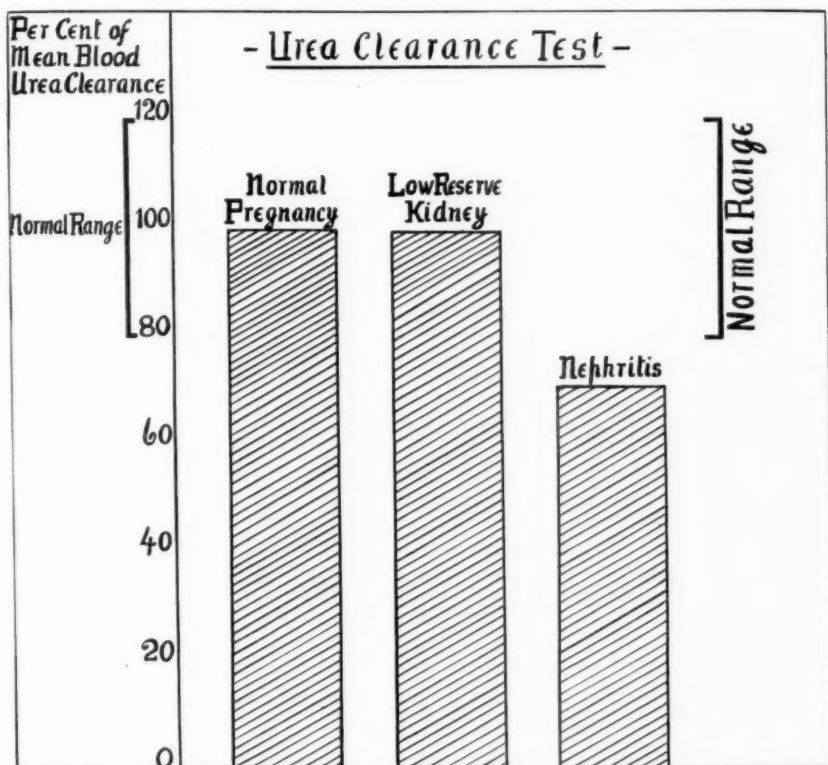


Fig. 4

and lunch; and so as not to interfere with the routine ward work, the best period is 8:00 to 10:00 A.M.

TEST

The patient is given the regular ward breakfast at 6:00 A.M., but *without* coffee or tea.

1. The patient voids at 8:00 A.M., and is given 200 c.c. of water. Specimen is discarded and the time of voiding noted carefully.

2. Slightly before 9:00 A.M., a sample of blood (about 20 c.c.) is taken, and sent to laboratory.

3. At 9:00 A.M., a specimen of urine is collected; 200 c.c. more water given. The exact time of this urine collection is again carefully noted and the specimen saved for laboratory.

4. At 10:00 A.M., another urine specimen is collected, the time of collection carefully noted, and the specimen saved for laboratory.

FORMULA

If urine volume per minute is 2 c.c. or above, use the following formula:

$$C_m = \frac{U \times V}{B} \times \frac{1.73}{A}$$

where C_m is maximum urea clearance,
 U is urea nitrogen per 100 c.c. urine,
 V is minute volume of urine,
 B is urea nitrogen per 100 c.c. blood,
 A is body surface area in square metres.

If volume is below 2 c.c. per minute,

$$C_s = \frac{U}{B} \sqrt{V \times \frac{1.73}{A}}$$

If we wish to express the urea clearance in percentage of normal, the above formulae are changed as follows:

$$C_m = 1.33 \frac{U \times V}{B} \times \frac{1.73}{A}$$

$$C_s = 1.85 \frac{U}{B} \sqrt{V \times \frac{1.73}{A}}$$

It is suggested that the urea clearance in all cases be reported as percentages of normal. The urine urea is determined by the Folin method¹² and the blood urea by that of Looney.¹³

The creatinine and guanidine tests of Major are of definite help to us. These tests run fairly parallel, and as the guanidine determinations are quite tedious and complicated, we recommend the use of the creatinine test. The procedure is simple. The test is carried out by collecting the urine for one hour, then injecting intravenously 0.5 gm. of creatinine. The amount of creatinine excreted in the urine during the first and second hours after the injection is compared with the creatinine content of the urine before injection. The results are best recorded in a graph as shown in Fig. 2. The creatinine may be put up in 10 c.c. sterile ampoules containing 0.5 gram creatinine in buffer solution of P_H 6.9. The determination of creatinine in the urine is an easy and short procedure, requiring simple apparatus.¹⁴

We have attempted to evaluate the various kidney function tests in order to determine which of them are of definite value in the recognition of a beginning or mild nephritis, where in cases in which signs and symptoms of the disease may be confused with low reserve kidney or pre-eclampsia. We feel strongly that all cases of nephritis, however mild, complicating pregnancy, should be recognized and treated properly, especially in view of the recent follow-up study of Stander and Peckham,¹⁵ in which they found a maternal mortality, occurring within ten years, of over 40 per cent in their patients suffering from nephritis during pregnancy.

CONCLUSIONS

1. Of the Mosenthal, phenolsulphonephthalein, diastase, thiosulphate, urea concentration factor, urea clearance, guanidine and creatinine excretion tests, the latter three proved of real value in the differentiation between mild nephritis and the other toxemias of pregnancy.

2. We recommend the urea clearance and creatinine excretion tests for routine use in all cases of toxemia of pregnancy where the diagnosis is not clear. A urea clearance of below 80 per cent of the mean normal, and a creatinine excretion below 155 mg. in the first hour, are strongly indicative of renal damage.

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MICROSCOPIC CEREBRAL HEMORRHAGE IN STILLBIRTHS AND NEWBORN DEATHS

A STUDY OF FIFTY-THREE INFANTS WITH RELATION TO MINUTE HEMORRHAGES OF THE MEDULLA OBLONGATA

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IT SEEMS imperative to obtain more definite pathologic evidence of the cause of death in that group of children, stillborn or dying shortly after birth, so frequently certified as "atelectasis, asphyxia, inhalation of amniotic fluid, tentorial laceration, or cause of death undetermined."

Among others Crothers¹ has emphasized the predominant role of injury to the medulla oblongata as the important factor in birth trauma. In the studies of Schwartz² the brains of a large proportion of infants up to the age of five months had microscopic hemorrhages or distinct areas of degeneration in the regions adjacent to the lateral ventricles. These findings caused us to undertake microscopic examination of the medulla oblongata in a series of infants stillborn, or dying shortly after birth, to determine the presence of hemorrhages in that region.

We present the results of 53 autopsies from the New York Lying-In Hospital. This series was selected consecutively on the basis of development and freshness of the material and were all done personally by one

of us (Hemsath). The bodies were placed in the mortuary refrigerator at a temperature of 5° C., pending autopsy which included examination of head, trunk, and long bones. The histologic examination of the

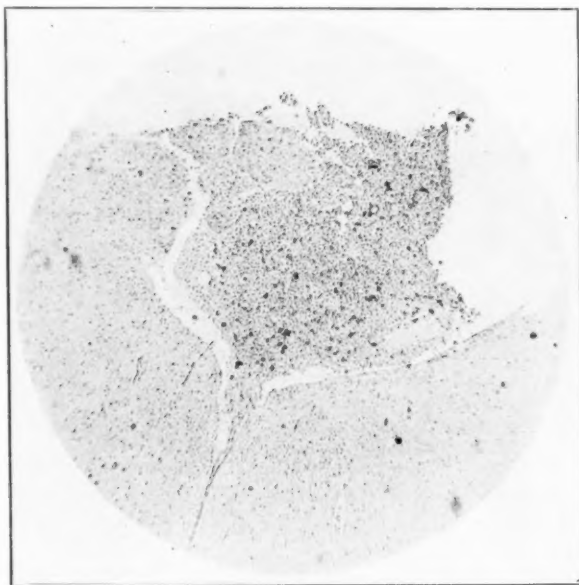


Fig. 1.—(No. 78561.) Mass of blood at side of medulla. $\times 60$. Cresylviolet stain.

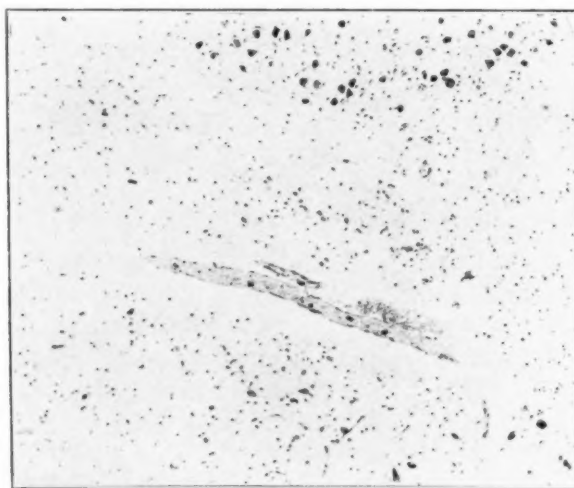


Fig. 2.—(No. 78308.) Note blood outside of vessel wall. $\times 120$. Cresylviolet stain

medullae was made by one of us (Canavan) without recourse to any data other than the weight of the bodies and the number of hours postmortem of the autopsy, and the amount of tissue used was about one gram in weight. We are reporting on single or at most two sections, cut six and two-thirds microns, and stained by a simple dye. Since we are considering for the moment findings which bear on the death of the infant, no

details will be given at this time of the histology of the medullae at this age, which is of much interest from the anatomist's point of view, but confine our figures to the vascular lesions which are in this study of prime importance. No instance of meningitis was seen.

Table I lists the 53 cases with relation to stillbirth or death, maturity, race, Wassermann reaction, and operative delivery. The etiologic factors in the causation of death of these 53 infants is given in Table II.

Microscopic hemorrhage in the medulla oblongata occurred in 34 cases or 64 per cent of this series, with equal incidence among stillbirths and

TABLE I. FIFTY-THREE INFANTS. GENERAL FACTS

	STILLBIRTHS		NEWBORN DEATHS	
	NUMBER	PER CENT	NUMBER	PER CENT
Total number	21		32	
Mature (weight over 2500 gm.)	15	71	20	63
Premature, viable (weight 1500 to 2500 gm.)	6	29	7	21
Premature, nonviable (weight 1000 to 1500 gm.)	—		5	16
Race, white	19	90	26	81
black	2	10	6	19
Wassermann reaction positive	1	5	3	10
Operative deliveries	14	66	18	56

TABLE II. ETIOLOGIC CLASSIFICATION OF DEATHS IN FIFTY-THREE CASES

	STILLBIRTHS		NEWBORN DEATHS	
	TOTAL NUMBER	NO. SHOWING MICROSCOPIC HEMORRHAGES OF MEDULLA	TOTAL NUMBER	NO. SHOWING MICROSCOPIC HEMORRHAGES OF MEDULLA
Complications of labor	13	9	12	8
Antepartum hemorrhage (including placenta previa)	5	3	2	1
Toxemia of pregnancy	2	2	—	—
Syphilis	—	—	1	1
Maternal diseases	1	—	—	—
Congenital disease or defects* (excluding syphilis)	—	—	3	3
Prematurity	—	—	7	3
Deaths due to postnatal causes	—	—	7	4
Totals	21	14	32	20

*General edema of fetus, habitual icterus gravis, renal aplasia.

TABLE III. STILLBIRTHS. FOURTEEN CASES SHOWING MICROSCOPIC HEMORRHAGES IN THE MEDULLA OBLONGATA* †

HOSPITAL NUMBER	WEIGHT, GRAMS	ETIOLOGIC CAUSE OF STILLBIRTH	OTHER ANATOMICAL DIAGNOSIS
78114	2680	Funis coiled about neck	Subserous petechiae of thoracic organs
78308	1800	Accidental hemorrhage	Subserous petechiae of thoracic organs
78327	2205	Prolapse of funis	Subserous petechiae of thoracic organs
78430	3525	Funis coiled three times about neck	Subserous petechiae of thoracic organs
79230‡	2700	Prolonged dry labor in V.O.P.	Edema of leptomeninges
79572	4300	Prolonged dry labor in V.O.A.	Subserous petechiae of thoracic organs
90995	3300	Premature separation of placenta	Subserous petechiae of thoracic organs
78148	2050	Accidental hemorrhage	Cerebral hemorrhage, profuse subdural supra- and infratentorial
79131	1650	Maternal toxemia	General edema of fetus. Subserous petechiae of thoracic organs
79481§	3400	Prolonged dry labor in V.O.P.	Syphilis, spirochete positive. Cerebral hemorrhage, moderate subdural infratentorial
79567	2950	Prolonged dry labor in V.O.A.	Complete bilateral laceration of tentorium with moderate hemorrhage
80387	4175	Eclampsia	Cerebral hemorrhage, moderate subdural infratentorial
80611	3200	Premature rupture of membranes	Intrauterine pneumonia
80900	3700	Prolonged dry labor in V.O.A.	Cerebral hemorrhage, moderate subdural supra- and infratentorial

*The cases grouped above the line are those in which the microscopic hemorrhages represented a more adequate cause of death than the other findings.

†At the date of preparation of this paper a baby dying without any voluntary respiratory movements was considered a stillbirth. More recently the New York City Department of Health has altered these standards.

‡Heartbeat for forty minutes following delivery.

§Heartbeat following delivery.

Abbreviations employed in tables: V.O.P., vertex occipitoposterior; V.O.A., vertex occipitoanterior; V.O.Tr., vertex occipitotransverse.

deaths. In 12 cases this finding established an anatomic diagnosis which would otherwise have been inadequate to account for death,* and thereby reduced the number of cases classified as "cause of death undetermined" from 32 per cent to 9 per cent of the series.

Tables III and IV list the 34 cases showing microscopic hemorrhages of the medulla.

*We have not considered subserous petechiae of the thoracic organs, the so-called asphyxial hemorrhages, as adequate anatomic cause of death.

TABLE IV. NEWBORN DEATHS. TWENTY CASES SHOWING MICROSCOPIC HEMORRHAGES IN THE MEDULLA OBLONGATA*

HOSPITAL NUMBER	WEIGHT, GRAMS	AGE		ETIOLOGIC CAUSE OF DEATH	OTHER ANATOMICAL DIAGNOSIS
		DAYS	HR.		
77990	2800		1/3	Flat pelvis	Complete laceration of left tentorium
78423**	3620		2/3	Generally contracted pelvis	
78542	2250		21	Normal labor with asphyxia	Atelectasis. Edema of leptomeninges
79555	2300		7	Prematurity	Edema of leptomeninges
79671	1800	1		Prolapse of funis	Prematurity
78447	2840	4		Prolonged labor in V.O.P.	Hematoma of liver with rupture
91053	3200	2		Syphilis	Bronchopneumonia. Syphilis
78546	1570	3		Prematurity	Bronchopneumonia. Cerebral hemorrhage, right temporal lobe
78561	3050		1	Prolonged dry labor in V.O.Tr.	Cerebral hemorrhage, moderate subdural infratentorial
78755	3450	3		Postnatal cause	Bronchopneumonia
78780	2800		3/4	Congenital disease	General edema of fetus. Edema of larynx
78863	3400		1/3	Prolapse of funis	Cerebral hemorrhage, extensive subdural supratentorial
91182	3950	6		Postnatal cause	Bronchopneumonia
79107	2300		2½	Placenta previa	Cerebral hemorrhage, moderate subdural supra- and infratentorial
79170	2490		1/6	Congenital defect	Renal aplasia
79172	3675		4	Postnatal cause	Pulmonary and mediastinal emphysema
79593	3250	2		Congenital disease	Habitual icterus gravis
80299	1120		1	Prematurity	Nonviable prematurity
80747	3500	22		Postnatal cause	Erysipelas
80992	3400	2		Nonengagement in flat, contracted pelvis	Extensive cerebral and pulmonary hemorrhages. No evidence of syphilis. (Maternal and cord Wassermann reactions positive)

*The cases grouped above the line are those in which the microscopic hemorrhages represented a more adequate cause of death than the other findings.

**Cesarean section before the onset of labor. Maternal Wassermann reaction strongly positive.

The one child in this series which lived more than six days died on the twenty-second day, of erysipelas. It had microscopic hemorrhages of the medulla which were old rather than recent, however, and recalls Sharpe's³ work on spinal fluid in the newborn.

The importance of small cerebral hemorrhages may be illustrated by two cases. Kirkwood and Myers⁴ have reported a death following inspiratory apnea in a newborn infant in whose brain at autopsy were found several small hemorrhages, the largest measuring 2 by 1.5 by 1.25 mm., just above the level of the olivary bodies. One of us (Hemsath) has performed an autopsy on a full-term infant (No. 83187) dying on the second day who had a spastic paralysis of the left arm and hand. The cerebral lesions were confined to tiny macroscopic and microscopic

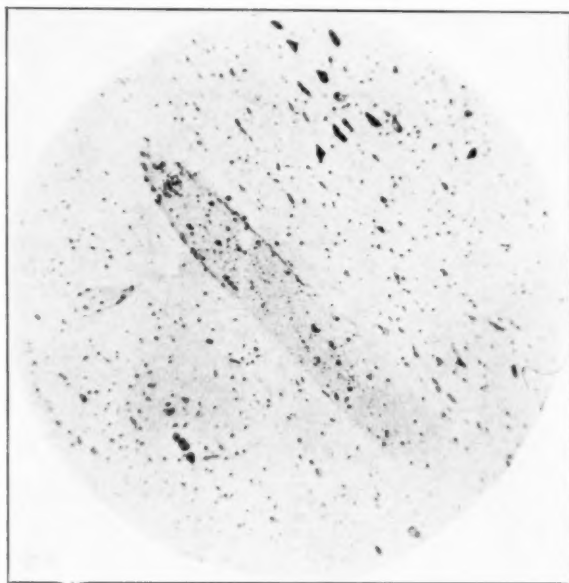


Fig. 3.—(No. 78542.) Note break in wall of vein with ooze of blood into tissue. $\times 110$. Cresylviolet stain.

hemorrhages of the white matter, radiating upward from the lateral ventricle toward the right anterior central gyrus. Thus clinical evidence of damage caused by small cerebral hemorrhages may be apparent though perhaps unrecorded at times.

The etiologic relation of the clinical factors in the production of these hemorrhages has been investigated. A series of 34 cases with hemorrhage and 18 cases without hemorrhage is not sufficiently large to be of much statistical value. Long labors and consequently cases with marked caput succedaneum and cases of occiputoposterior presentation showed a greater incidence of the lesions. Hemorrhages were present in all of the four cases of syphilis, one of which (No. 78423) was delivered by cesarean section before the onset of labor. The factors of primiparity,

age of the mother, type of delivery, whether spontaneous or operative, cord coiled about the neck, and maturity of the child did not apparently bear an etiologic relation to the microscopic hemorrhages. Schwartz explained the hemorrhages upon the basis of the difference in intrauterine pressure and atmospheric pressure which exists with rupture of the membranes and dilatation of the cervix. Voss and others² have reproduced the lesions in animals by vacuum cup experiments. On the basis of this theory the microscopic hemorrhages should not be found in breech presentations, nor were they present in the three such cases in our series. Again this figure is too small for statistical value.

Tentorial lacerations were found in ten deaths and four stillbirths in this series. In eight of this total of fourteen there was sufficient gross

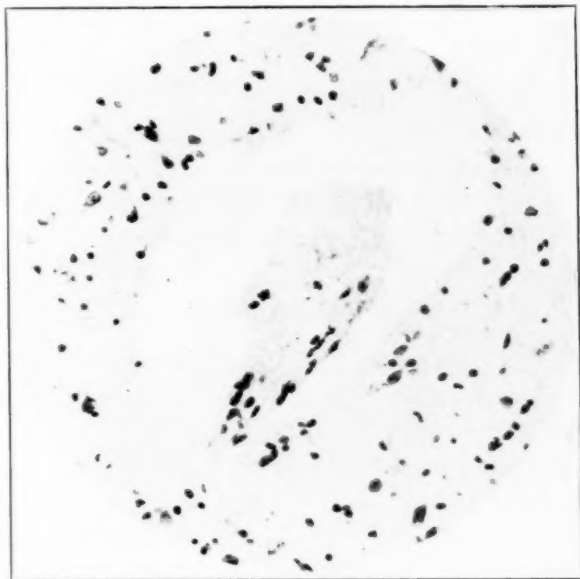


Fig. 4.—(No. 79671.) Capillary with escaped blood into space around vessel. $\times 240$. Cresylviolet stain.

subdural cerebral hemorrhage to account for death. In the other six cases without gross hemorrhage, microscopic hemorrhages were present in the medulla. These findings suggest that microscopic hemorrhages in the vital nerve centers may cause the death of many infants with tentorial lacerations without gross cerebral hemorrhages and replace the speculative theories advanced to explain the mortality in these cases. One of these theories considers that death is due to jamming of the pons into the foramen magnum. If this were the fact one would expect to find a pressure cone of the cerebellum in many of them. In the fourteen cases with tentorial lacerations in this series such evidence was found only once although it was looked for in all cases.

CONCLUSIONS

In microscopic examination of a single or two sections of the medulla oblongata in newborn deaths and stillbirths, there were microscopic hemorrhages in 34 instances (64 per cent) among an unselected series of 53 autopsies. In 12 cases this finding supplied an anatomical cause of death which would otherwise have been lacking.

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307 SECOND AVENUE
240 LONGWOOD AVENUE

OSTEOMALACIA IN PREGNANCY

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OSTEOMALACIA is regarded as a rare disease by the authors of many of our standard textbooks, but if one reads the medical journals from China and India, especially the latter, it is evident that it is a common disease in those countries. It occurs in these places in all stages, but it is particularly the early stage which I wish to emphasize, for I believe that osteomalacia is quite prevalent in this country. The increasing number of reports during the last three years of cases of calcium deficiency and avitaminosis, indicate that marked disturbances of metabolism not only occur but are relatively common if searched for. An excellent review of osteomalacia is found in Hess' book on rickets, and since this chapter, although concise, covers the disease in its entirety, I shall confine this paper to the early symptoms and signs, etiology and treatment as they may be related to pregnancy and the conditions found among our patients.

Workers in various parts of the world have come to the conclusion that there is probably no hard and fast line of demarcation between the so-called "late rickets" and osteomalacia. They believe that the etiology is the same. Extensive studies in China, by Maxwell and Miles, indicate that at least 2 per cent of their women have or have had the disease. The Chinese themselves claim that the incidence may rise as high as 10 per cent of the childbearing women of adult age. In certain districts 2 or 3 per cent of the pregnant women die from this disease. The incidence in India is also very high, for Wilson, Hughes, Stapleton, and Green-Armytage each report large series, Wilson himself reporting a series of 73 cases. Green-Armytage states that

in the course of thirty months in the Eden Hospital in Bengal there were 2,870 maternity cases, and it was necessary to perform 26 craniotomies and 15 cesarean sections for osteomalacic conditions alone. Its frequency in other countries is not known, although DeLee states that about 25 per cent of our women have mild osteomalacia, but he does not give the symptoms nor does he suggest any treatment.

The disease in China is associated more frequently with pregnancy, but in India this is not true. However, the period of greatest frequency of the disease is from puberty to the menopause. Pregnancy and, to a less degree, lactation have been considered among the etiologic factors of the disease; in fact, formerly the ovaries were removed to cure it. There is no doubt that pregnancy plays an important part, but the relationship to puberty is even closer. It was formerly thought that the demand of the fetus for calcium was the cause. However, Hoffström finds that the fetus at twenty-eight weeks contains only 5.38 gm. of calcium and 30.51 gm. at term, but among the cases reported by Huchison and Stapleton, 25 of the 26 occurred previous to the seventh month and 13 at or before the fifth month of pregnancy. Thus the theory that a drain of five grams of calcium would result in osteomalacia is clearly fallacious. The close association with puberty and pregnancy, during which periods we have marked changes among the internal glands, would lead one to think that a glandular defect might be one of the causes. It has been shown that during menstruation the calcium balance becomes negative and the difficulty encountered in maintaining a positive balance in pregnancy lends support to the glandular theory.

In China, Maxwell and Miles find that the disease is limited to the middle class. The wealthy people eat a balanced diet containing meat, eggs, milk, and butter. The diet of the poor is made up of cereals, with a limited quantity of vegetables and, as a rule, no meat, milk, or eggs, and but little animal fat, the oil used for cooking being mainly vegetable. The diet of the middle class is naturally intermediary between these two, but also contains little meat, milk, or fat of animal origin. The women of the poor class are compelled to help their husbands in the fields and thus are exposed to sunlight. The middle class women spend the major portion of their time sitting on the "kang" (a heated platform on which the Chinese sleep), and naturally have little or no exposure to sunshine. The women of the wealthy class spend their time similarly but their deficiency in sunlight is compensated for by their diet.

In addition to the vitamin deficiency there is the character of the diet. Mellanby states that cereals, especially oatmeal, not only do not contain vitamin "D" but do contain some definite anticaleifying substance, which he calls "toxamin." He showed in dogs that on a diet which was deficient in vitamin "D," when other dietary and environmental factors remain the same, doubling the amount of cereal made the rickets distinctly worse.

In India, osteomalacia is most common among the Mohammedans and high-caste Hindus who practice the system of "purdah," in which the women are confined to small dark rooms and during their short periods in the sunshine, which occur, as Scott states, only during a marriage, death, or religious festival, are covered with heavy black veils.

Osteomalacia does not occur among the poor in India whose diet is mainly cereals, because the women have to help in the fields, and as a result of the sunlight have sufficient vitamin "D" so that the "toxamin" from the cereals is neutralized. Thus we have conditions analogous to laboratory experiments. Osteomalacia occurs in China among the middle class whose diet is deficient in animal fat and who have little or no exposure to sunlight. In India, we find it prevalent only in the wealthy, who have fairly well balanced diets but whose customs result in a lack of exposure to sunlight. The common factor found both in China and India is a lack of sunlight or vitamin "D."

In China, the disease is known as the "back and thigh pain." In some cases pain in the lumbar region precedes that in the thighs. It is of an aching character, coming and going, better some days than others, and worse during the winter months than in the summer. The patient may complain of stiffness in the back when getting up and of pain when she tries to hold herself erect; Table I, taken from Wilson,

TABLE I. FIRST SYMPTOMS NOTED BY PATIENT. TOTAL CASES OBSERVED, 135.
(FROM WILSON AND SURIE)

GROUP TO WHICH SYMPTOM REFERRED	NO. OF CASES
PAIN	
Lumbosacral	39
Pelvic girdle	36
Lower extremities:	
Long bones	31
Joints	18
Ribs	7
Shoulder girdle	4

shows the first symptoms noted by the patient. Green-Armytage finds in some cases that the symptoms are more gastric or intestinal, with great distention and inability to digest food. In some of these the anemia was very great and girdle pains, resembling the gastric crises of locomotor ataxia, were a marked feature. He found that in some cases there was almost complete paralysis below the waistline after child birth, and because they had no pain whatever, the diagnosis was usually that of an organic cord lesion. Under proper treatment, he reports these women walking about within a month. He finds others complaining of numbness or pain in the extremities, and in some this numbness was associated with the sensation of ants creeping over the skin, particularly in the waistline and lateral parts of the thighs. In a few cases, faceache or toothache with neuralgia was the main complaint besides the anemia. He points out that it is all important to remember that typical body changes, due to softening of the bones, are by no means a necessity. In the early case no more than a slight loss of definition in the detail of the bones can be detected. The deformities occurring in the late cases, due to the softening of the bones, require no extensive description.

Another statement which is made is that the serum calcium in osteomalacia is low. This is not true, for in many of the reported cases the serum calcium may be low, normal, or high. Hughes and his coworkers, in 27 cases of osteomalacia, report only three in which the serum calcium was between 7 and 8 mg. per cent. The remainder of his cases had serum calciums varying from 10 to 15.7 mg. per cent, with an average of 13.15. Of their cases, one was early, 12 moderate, and 14 marked. All of the 10 cases reported by Miles had serum calciums varying from 5.0 to 7.5 mg. per cent. Blumgart, Gargill, and

Gilligan report a nine-day period of study of a case of osteomalacia, with eight serum calciums at different periods varying from 10.3 to 11.0 mg. per cent. The explanation of the variation in the serum calcium may be found either in the duration of the disease, that is, a low serum calcium occurring in those cases in which the bones have been markedly depleted of calcium, or in a change in the ratio of free and bound calcium.

Serum phosphate was usually normal, although in some cases, especially those of Maxwell and Miles, low values were found.

The diagnostic aid which is of greatest importance is the calcium balance. This study is time consuming and requires a completely equipped laboratory, and, as a result, few studies are available. The reported cases of calcium and phosphorous metabolism in pregnancy, including two unreported cases of our own, indicate that the minimal intake in pregnancy for each element should be 1.5 and 2.0 gm., respectively. Hunscher has shown that if large amounts of milk are secreted it is impossible to maintain a positive calcium balance by diet alone.

In osteomalacia the calcium balance is usually negative although certain patients at times may show a positive balance. Numerous factors enter into this phenomenon, such as the acidity of the diet, exposure to sunlight, ingestion of fats, etc. Maxwell and Miles, in a seven-day study of calcium and phosphorous metabolism in four pregnant Chinese women, report that three had a negative calcium balance, showing a daily loss which varied from 0.05 to 0.84 gm., and that one had a positive balance of 0.44 gm. The average daily intake was approximately 0.5 gm., and the phosphorous metabolism was positive in all. The addition to the diet in three cases of 24 c.c. of cod liver oil daily was sufficient to produce a positive balance. Olive oil and calcium lactate in one case did not produce a positive balance. Blumgart, Gargill, and Gilligan, in a case of osteomalacia, found in a nine-day study period that there was a daily retention of 1.46 gm. of calcium.

Hartley, in a recent report, ascribes the pains, insomnia, and paresthesia occurring in pregnancy, as due to a disturbance of calcium metabolism, producing in the individual a tetanoid state.*

We have had a number of women complaining of cramps in the legs, pain in the back, abdomen and symphysis, or difficulty in walking, the latter being associated at times with marked mobility of the symphysis, and we have treated these patients in various ways, either considering the cramps as due to pressure of the head, neuritis, or what not. It is noteworthy that attention has been given on our service to these symptoms only since 1921. They undoubtedly occurred before but were not thought of sufficient interest to diagnose.

*I believe the symptoms in his cases are those of an early osteomalacia.

TABLE II

CASE NO.	AGE	COLOR	G.	LAST PERIOD	SYMPTOMS	DATE OF DELIVERY	DURATION OF REPRODUCTIVE PERIOD YEAR	INCOME PER MONTH \$	NUMBER IN FAMILY
1-2756	29	W	7	1-15-16	Pain in all joints for 4 yr. Kyphosis, scoliosis, multiple fractures		9		
2-3778	22	W	2	None	Pain in symphysis 6 days postpartum	11-29-21	1½	Private Patient	3
3-4401	31	C	5	1-10-22	Tenderness over symphysis 4 days postpartum	11-3-22	11	60	7
4-4468	26	C	2	3-7-22	Pain in symphysis 3 days postpartum	11-25-22	1½	150	3
4-a			4	7-17-25	1-7-26 Walks with difficulty	4-2-26	4	111	5
5-5988	26	C	9	3-25	At 2 mo. legs became weak and numb. Unable to walk for 4 wk. Same trouble with previous pregnancy	12-9-25	10		7
6-6295	29	C	3	?	At 2 mo. pain in symphysis and difficulty in walking. Similar trouble in previous pregnancies	3-13-25	10	100	4
7-6998	24	C	3	4-15-26	Pain in lower abdomen for 1 yr. Tender symphysis since 12-2-25	1-31-27	4	40	5
8-9679	26	W	4	6-18-27	Pain on moving 3 days postpartum	3-15-27	8	160	6
9-3687	22	W	4	3-1-28	Pain on walking. Sep. symphysis 6 wk. antepartem	12-19-28	4	150	5
9-a	23	W	5	9-15-29	Pain in walking. Sep. symphysis 6 wk. antepartem	6-7-30	6	150	6
10-4587	31	C	4	3-1-29	Pain in symphysis 1-15-29	3-5-30	8	90	7
11-6911	32	C	4	3-1-29	Pain in back at 8 mo.	12-13-29	12	100	5
12-3862	32	C	8	5-1-28	Unable to walk Separated symphysis	1-20-29	11	60	7
12-a	33		9	8-8-29	"	4-19-30	12	60	8

Table II lists a series of 15 observations in 12 patients. Pertinent data are given. The occurrence of all of the cases between the ages of twenty-two and thirty-two is due to two factors. One is that this is the period of greatest productivity and second the income is naturally lowest during this period. Eight were among the colored, again indicating first a financial factor and second less ultraviolet rays could be absorbed because of the black skin. Although all of the patients were multiparae, the principal factor was the short interval between babies. In the six ob-

servations on three patients the interval was approximately a year. Four patients first noted symptoms from three to six days postpartum. During this period lactation begins and the symptoms are presumably due to the sudden and great drain on the body for the calcium and phosphorous in the milk. The remainder, as a rule, tended to begin in the last three months when the demand for calcium and phosphorous would be greatest. All of the patients had pain in the symphysis and frequently some difficulty in walking. Usually there was more movement than normal in the symphysis, but this mobility, although decreased, is still present in three cases seven to fifteen months after delivery. However, the pain and difficulty in walking has disappeared.

In addition, there have been nine patients in the past two years who have been completely relieved of symptoms following the administration of cod liver oil; these were all ambulatory.

The relaxation of the symphysis, in my opinion, is not merely an exaggeration of the normal increase associated with pregnancy, nor is it a sign of reversion. (Relaxation of the symphysis and, in some cases, a complete absorption occurs in certain species of animals during pregnancy. In fact, the injection of serum into these animals from a pregnant woman will produce this change.—Todd, Hisaw.) We believe that the relaxation is definitely pathologic, and although relaxation of the joints has not been described in osteomalacia, it is worth noting that Barr and Bulger describe a case of parathyroid tumor in which a slightly increased mobility of the joints in childhood, as a result of the loss of calcium, became so marked that the patient was able to go to sleep with her head on her ankles.

CASE 1, as the data on the chart indicate, was undoubtedly a case of osteomalacia. Cases 2 and 5 were the only ones in which the x-ray was able to show signs of resorption of bone. Cases 6 and 11 exhibited the waddle in their gait, characteristic of osteomalacia. Abstracts of the histories of typical cases are as follows:

CASE 2.—White, twenty-two years old, a private patient (second pregnancy in 19 months) was admitted November 28, 1921, and delivered on the following day by an easy low forceps. On December 5, she complained of intense pain in the symphysis. Upon examination a marked tenderness along the ascending rami of the pubis was noted. X-ray report: Anterior portion of either ischium and the symphysis present diminished density, suggestive of changes in the bone. Patient was relieved by a tight binder and was discharged on December 31.

CASE 4.—Colored, twenty-six years old, was delivered spontaneously on November 25, 1922, of a 2,000 gm. living baby. On November 28, she complained of acute pain in the symphysis and interference of movements; strapping gave relief. She had had two pregnancies in eighteen months. On January 7, 1926, when twenty-six weeks pregnant, she was again admitted because of difficulty in walking; marked mobility of the symphysis was present. Strapping gave relief. She delivered on April 2, 1926, and on discharge was well. She had had four babies in five years.

CASE 5.—Twenty-five years old, colored, gravida eight, seven weeks postpartum, was admitted on August 28, 1924, complaining of pain and swelling of feet. She had

been delivered at home by a colored doctor and had had a curettage when one week postpartum. She had been delirious and unconscious for four days, was in bed three weeks, and has since been incapacitated. On admission the pelvic examination was negative except for marked tenderness of the sacrum on the right. Neurologic examination: K.K.'s and A.J.'s not obtained. The patient was examined by numerous medical men and each one had a different diagnosis. She was given intensive anti-syphilitic treatment, and eventually discharged as improved. Was readmitted on obstetric service December 28, 1925, as a gravida nine with five living children. Unable to walk for four weeks. Last menstrual period March, 1925. Has been vomiting since November. Wassermann negative December 28, 1925; Kahn three-plus. Delivery of 2,500 gm. baby December 29, 1925. My note was as follows: Marked malnutrition together with pain, etc., suggestive of osteomalacia. Up to four years ago the patient lived in the country and the diet contained large amounts of chicken, cream, milk, fresh vegetables, etc. Patient weighed 160 pounds. She had had nine pregnancies in ten years. There are now six children living. The diet during this pregnancy did not contain much, if any, of the above articles. She had pains in the soles of her feet with some radiation upward before the baby was born in 1924, which were increased markedly after the last delivery, but she had recovered entirely at the time of discharge from the hospital. From Thanksgiving day, she was in bed and was waited on by her children. On some days she had received little, if anything to eat. During the last two pregnancies she had no desire to eat. Her reason for going to bed was "false pains." She states that whenever she got out of bed she would have a burning sensation in the soles of her feet and then pain in the thighs and back, followed by "false labor pains." Since delivery she feels much better. Serum was calcium 8 mg. per cent. February 3, 1926, elastic tissue and tubercle bacilli found in sputum. Patient sterilized on January 22, 1926. X-ray of pelvis demonstrated questionable rarefaction of the descending ramus of the pubis on the left. Also a questionable rarefaction of the extremities of the bones of both legs and both upper extremities. Weight on admission 106. Weight on discharge 97½. She was given cod liver oil and calcium lactate during the hospital period. Was normal at discharge except for underweight. She was able to do all of her housework for eight months. She died February 22, 1927, of influenza.

CASE 6.—Colored, twenty-nine years old, was admitted on December 16, 1924, for diagnosis. She was approximately twenty-eight weeks pregnant. She complained of pain in the lower abdomen, lower back, right hip and right leg, and a weakness and dragging of the right leg. Has had two children in sixteen years. With each pregnancy she had the same disturbances such as she now has. About two months after the beginning of each pregnancy, she stated that she would have pain in the lower abdomen, like needles sticking her, then difficulty in walking and cramps in her legs. After delivery all of the symptoms subsided. Examination: Hyperesthesia over the back on the right side below the ninth vertebra. Definite weakness in the right leg and movements of leg suggest some spasticity. She had a marked and persistent lordosis.

Dr. Schwarz's note: "Patient sent into hospital on account of peculiar gait, walks with legs slightly abducted and stiff at knees. X-ray films of spine and pelvis are negative. Patient is of very low mentality—complains of pain over lower spine and pelvis. States that this has never been present before this pregnancy, but has developed particularly in the past two months. Patient apparently has not been eating proper food and has probably been quite inactive." She was delivered in March and then placed in the City Sanatorium because of her mental deficiency. On May 6, 1931, the patient was seen at the St. Louis City Sanatorium for the Insane. Weight 163 pounds. Still had marked lordosis with very prominent buttocks and the peculiar walk.

CASE 11.—Colored, thirty-two years old, was admitted on November 26, 1929, because of pain in the lower abdomen and back when standing or walking. This is her fourth pregnancy in twelve years. She has had the pain since October 1, and states that she had not been out of the house for about two months. The pain was so acute at first that she remained in bed. Her calculated date of delivery was December 8, 1929. In a period of four months she had gained only six pounds. Examination: Negative except for the marked mobility of the symphysis. X-ray: The right pubic bone was at a slightly lower level than its fellow, but the width between the bones was within the normal limits. She was placed on a diet containing 125 gm. protein, 200 gm. fat, and 250 gm. carbohydrates. The diet was rich in vitamins and, in addition, 4 c.c. of cod liver oil were given three times daily. She was encouraged to move about and one week later the pain had disappeared and she was able to walk without difficulty. On December 13, she was delivered of a 2,300 gm. living baby. On September 25, 1930, she weighed 170 pounds and has had no pain since leaving the hospital. Increased mobility was still palpable.

CASE 12.—Colored, thirty-two years old, was admitted to the hospital because of pain in the pelvis and back. She stated that about three months ago when on her way to the clinic she suddenly fell. Since then, she has had no control over her legs, and any movement causes intense pain. In 1924, the patient first noticed difficulty in walking when she was thirty-eight weeks pregnant. This had followed a fall and she had been told that she had a fracture of the pelvis. Examination was negative except for extreme mobility of the symphyseal joint. The patient was strapped, but this did not relieve her, and she was kept in bed until her delivery (a period of eight weeks). At the time of discharge she was still unable to walk and did not regain complete control of her legs until the baby was two months old.

Patient was readmitted to hospital on March 8, 1930, for similar complaint. She was approximately thirty weeks pregnant and again without warning had fallen on

TABLE III

MARCH 1930	PERIOD OF STUDY DAYS	CALCIUM GM.		PHOSPHORUS GM.	
		INTAKE	OUTPUT	INTAKE	OUTPUT
14 - 23	10	33.53	16.57	25.88	11.98
24 - Apr. 2	10	31.67	16.46	21.76	14.53
3 - 18	16	54.29	30.59	38.14	22.14
Total		119.49	63.62	85.78	48.65
<i>Av. per day</i>		3.32	1.77	2.38	1.35
Delivery:					
19 - 28	10	34.57	20.70	24.33	12.93
<i>Av. per day</i>		3.46	2.07	2.43	1.29
Operation:					
May 4 - 13	10	32.3	18.27	21.72	9.72
<i>Av. per day</i>		3.23	1.83	2.17	.97

the way to the clinic. Examination again was negative except for movement in the symphysis and many carious teeth which showed a marked deterioration since the previous examination. The patient was asked to remain out of bed as much as possible. Calcium and phosphorous metabolism were studied with the patient on a diet containing 150 gm. of protein, 275 gm. of fat, and 320 gm. carbohydrates, together with 5 gm. of calcium gluconate three times daily. Viosterol (10 drops three times daily) and plenty of fresh fruit, vegetables, and cream were given for their vitamin content. After a minor gastric upset, due to the marked increase in food, the patient was able to take the diet which gave 4,400 calories, without much trouble. The pain did not subside completely, but the patient was able to walk daily and had no more falls. She was able to walk to the delivery room on the nineteenth of April when she delivered a 2,500 gm. living fetus. Lactation was stopped to prevent loss of calcium in the milk. She was sterilized by a tubal resection and ligation on April 30. She had had nine children in a period of 12 years. Her diet consisted, as a rule, of one meal per day which was a stew containing vegetables and meal. There was little or no meat, fresh vegetables, or fruit, and no butter or milk. All of the previous babies had severe rickets. The patient has been followed up to the present and has had no difficulty in walking and has had no pain. Palpation of the joint showed that it was still movable, but apparently to a less degree. She has been seen at periodic intervals and has lost weight steadily. In June, 1931, her weight was 95 pounds. This loss is due to improper and insufficient food.

The metabolism studies were made over a period of sixty-one days and the data for calcium and phosphorous are given in Table III. Analyses of urine and feces were made daily, but have been grouped into periods of from five to ten days each. During the sixty-one days of diet control, the average daily intake of calcium, excluding the postoperative period of five days, was 3.32 gm., and the average output was 1.83 gm., giving a daily positive balance of 1.49 gm. In the entire period 87 gm. of calcium were retained. As the total calcium content of the fetus when born is stated by Hoffström as 30.51 gm., it is evident that the patient's calcium stores had been markedly depleted. The average phosphorous intake was 2.63 gm. per day and the output 1.34 gm., giving a daily positive balance of 1.29 gm. During the period of study, 60 gm. of phosphorous were retained. These tremendous retentions indicate that the patient had been starved for these substances and the marked assimilation for calcium warrants the diagnosis of osteomalacia.

The serum calcium and phosphorous on admission were 10.8 and 3.57 mg. per cent. A serum calcium on March 12, 1930, was 8.5 mg. per cent. As a result of the viosterol, the calcium rose to a maximum of 14.2 and the phosphorous to 5.0 mg. per cent. These dropped rapidly and three weeks after discharge they were 10.6 and 2.63 mg. per cent, respectively, and have remained normal until March 18, 1931, and June 3, 1931, when the calcium was 8.9 and 8.4 mg. per cent, respectively.

The diagnosis of early osteomalacia should be based on the symptoms and not on the x-ray. There are approximately 1,500 gm. of calcium in the skeleton, and it is evident that the negative calcium balance must be of long duration before bony changes can be detected with the x-ray. Furthermore, it requires a long time to replace this calcium. Bulger has recently studied a case of parathyroid tumor which, after operation, retained as much as 2.0 gm. of calcium per day in some of the periods, and yet it required a period of seven weeks to show x-ray changes. In osteomalacia where the disease presumably is still active, the repair process is much slower.

One other phase of osteomalacia which should be considered is the effect on the baby. Green-Armytage states that in osteomalacia the fetus also suffers from a lack of calcium and that "when born it is skinny and its long bones are poor in ostrin and chondrin, while the epiphyseal zone of calcification is irregular. If the physician does not realize this, the infant may die from calcium and vitamin deficiency." Maxwell reports two cases of fetal rickets. One baby died on the fourth day and at the postmortem there was definite evidence of rickets, while the other diagnosis was based on the x-ray evidence.

The development of the teeth of infants begins at the sixth or seventh month of fetal life, with the deposition of lime salts in the crowns of the temporary teeth. At birth all of the temporary teeth are calcified and the crowns of the permanent first molars are partially calcified; hence it might be expected that the diet of the mother during pregnancy would exert an influence upon the development of the teeth. Mellanby found on diets deficient in the calcifying vitamin the dentine of the deciduous teeth of the offspring often contains small interglobular spaces and the enamel might be defectively calcified, indicating that the mothers had been unable to supply from their own bodies a sufficiency of the factors necessary to insure perfect calcification. Toverud obtained similar results in rats.

SUMMARY

Osteomalacia must have an earlier stage than the one which is characterized by marked deformities of the bones. The diagnosis should be made on the symptoms and evidence of calcium deficiency, as determined either by metabolism studies or by an analysis of the diet. The serum calcium need not be subnormal to warrant a diagnosis of osteomalacia, nor do the bones in the early stage show any signs of absorption perceptible to the x-ray.

There is a definite association between pregnancies at short intervals, insufficient or improper diet and the occurrence of pain in the symphysis, back and thighs, and difficulty in walking.

The diet of the pregnant woman should be carefully supervised in that it should contain as a minimum, 1.5 gm. of calcium and 2.0 gm. of phosphorous, sufficient butter and milk, and fresh vegetables and fruits for the vitamin content. In many patients, especially where there is an economic problem, the diet should be supplemented with calcium and cod liver oil. This applies in particular to the negro race. The result will be that the women will have less disability because of calcium deficiency and less decay and softening of teeth. The baby will be started with its proper store of calcium and phosphorous and will be less liable to develop rickets. Furthermore, since the deciduous teeth are formed in utero, they will have their proper composition and be less likely to decay.

METHODS

The diets were weighed and any unconsumed portions were again weighed by the same dietitian. The calcium and phosphorous intake was calculated from the analysis of food collected from the literature by Sherman. Three standard diets were made up and given to the patient on different days. Each contained 4,500 calories, but the average amount consumed was equivalent to about 3,500 calories.

Each diet was thoroughly ground up and cooked with frequent additions of water until a homogeneous mass was produced. The volume was then determined and aliquots taken for analysis. The results are listed in Table IV.

TABLE IV

	CALCIUM		PHOSPHOROUS	
	CALCULATED	DETERMINED	CALCULATED	DETERMINED
I	2.091	2.7	2.904	2.15
II	2.605	2.72	3.356	4.10
III	2.282	2.18	3.071	4.52

The stool and urine collections were under the supervision of the head nurse and a technician. The calcium in the urine was determined by the method of Shohl and Pedley, and that of the feces by the method of Corley and Dennis. Aliquots of the latter were used for total phosphorous. The total phosphorous of the urine was determined by the uranium acetate method. Constituents of serum and blood were determined by the usual accepted methods.

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MENORRHAGIA DUE TO HYPOTHYROIDISM

By W. C. WATERS, M.D., AND GEORGE A. WILLIAMS, M.D., ATLANTA, GA.

IT IS universally conceded that the function of the thyroid gland is intimately connected with that of the ovaries, but the exact relationship is a matter of dispute. The clinical application of such knowledge is likewise confusing, and literature on the subject is a mass of conflicting data.

The syndrome of hypothyroidism is quite generally assumed to include scanty menstruation, or even amenorrhea. Craddock,¹ Gregory,² Higgins,³ Sanderson,⁴ and others mention the efficiency of thyroid substance in the treatment of certain cases of diminished menstrual flow. Marine⁵ states that "menstruation is often irregular, or even ceases, but well defined cases (of hypothyroidism) may have regular menses." He further says that "menorrhagia of varying degree is an important symptom and some patients date the onset of their disease from excessive bleeding." Graves⁶ ascribes both amenorrhea and menorrhagia to myxedema and says that administration of thyroid substance may benefit equally the two conditions.

Gardiner-Hill and Smith,⁷ reporting 59 cases of myxedema, concluded that amenorrhea was not a symptom of hypothyroidism but that menorrhagia was usual in the disease. Twenty-three of their 59 patients were observed before the menopause; of these, 18 had menorrhagia while 4 menstruated normally, and one not at all. These authors believed that menorrhagia, occurring during the menopause and not attributable to local causes, is significant of hypothyroidism. They stated that "myxedema is a common sequel to the artificial menopause when the latter has been induced for menorrhagia" (in those patients with no apparent pelvic pathology).

Lisser⁸ never encountered amenorrhea as a symptom of hypothyroidism, stating that "the interval between periods is apt to become irregular, sometimes short and sometimes long, but the flow is very copious and may continue for a week to a month or more. The administration of thyroid corrects this excessive hemorrhage and restores the normal periodicity." He described "adolescent menorrhagia of hypothyroid origin" as a clinical entity in which there is an early development of the secondary sexual characteristics accompanied by early onset of menstruation which becomes profuse and prolonged. Lisser concluded that "in the absence of local causes in the pelvis, an early onset of menstruation together with long and continued bleeding is suggestive of hypothyroidism."

The following cases are selected to illustrate the menorrhagia due to hypothyroidism and to demonstrate the efficiency of thyroid substance in correcting the disorder.

CASE 1.—An eighteen-year-old girl on September 11, 1930, stated that since the onset of menstruation at the age of twelve, the flow had been very profuse, frequently lasting over periods of three months. Intermenstrual intervals had seldom approached two weeks in length and weakness was a constant complaint. Rest in bed on the advice of physicians had not retarded the flow. Radiation, and finally, operation had been advised and refused. For the past three months the flow had been constant and excessive. She also complained of sluggishness, fatigue, and sensitivity to cold.

Examination revealed a normal height-weight ratio and a marked secondary anemia. From rectal palpation the pelvic organs appeared to be normal. The breasts, external genitalia, and hair distribution suggested no endocrine dysfunction.

The basal metabolic rate could not be determined because of the highly apprehensive state of the patient. There was a marked hypochromatic anemia, the erythrocyte count being 2,960,000 and the hemoglobin 45 per cent (Dare).

She was given copper and iron and one grain of thyroid extract daily. By October 1 the dosage of the gland had been increased to 6 grains daily. The amount of flow gradually diminished, and on October 6, twenty-four days after institution of treatment, her bleeding ceased altogether. Subsequent periods (October 24-29, November 17-21, December 15-19, 1930, and January 13-18, 1931) were normal in duration and amount of flow.

On October 16 the erythrocytes numbered 3,800,000 and the hemoglobin had increased to 70 per cent. Three weeks later there were 4,090,000 red cells and the hemoglobin was estimated to be 80 per cent.

Thyroid substance was omitted on January 20 and the subsequent period in February was markedly increased in amount. The patient also complained of returning fatigue and sluggishness, so the use of the gland was resumed.

It may be suggested with some justification that this case was one of chlorosis rather than hypothyroidism and that relief from menorrhagia was due to the coincident administration of copper and iron and not to thyroid gland therapy. The usual menstrual tendency in chlorosis is toward amenorrhea, however, and it is to be noted that the bleeding in this case ceased before appreciable improvement in the blood picture. Moreover, there was no evidence of thyrotoxication in spite of large doses of the gland.

CASE 2.—A woman, thirty-eight years of age, complained of profuse menstruation which usually lasted from ten to fourteen days, accompanied by severe headache. She was markedly sensitive to cold and suffered fatigue on slight exertion.

The thyroid gland was slightly and uniformly enlarged and the skin was rather dry. The blood pressure was normal but the pulse rate was 92 per minute. The pelvic organs presented no abnormality.

Blood examination disclosed a moderate secondary anemia. The basal metabolic rate was minus 19.

On the administration of 2 grains of thyroid extract daily the menstrual period was reduced to four days and the amount of flow became normal. Overconfident, the patient used the gland only at irregular intervals during the next month and the subsequent period continued profusely for ten days. On resumption of the original dosage of thyroid extract, the flow again became normal and has remained so up to the present time, eight months after the institution of treatment. The use of the gland had no effect on the basal metabolism but headache, weakness and chilliness were relieved.

CASE 3.—A woman, thirty-eight years of age, stated that since its onset at the age of twelve, menstruation habitually recurred at intervals of twenty-one days and lasted profusely for seven days. The flow was reestablished six weeks after the birth of each of three children. For the past six months the intermenstrual intervals had been only fourteen to eighteen days, and the amount of bleeding had steadily increased. She complained of unusual sensitiveness to cold, easy fatigue, and the persistence of obesity in spite of self-imposed dietary restrictions.

Examination showed excessive but uniformly distributed fat. The skin was dry and the temperature was subnormal. There was no pelvic pathology to explain the menorrhagia. The basal metabolic rate was minus 5.

One grain of thyroid extract was administered daily with no effect upon the succeeding period. After increasing the dose to three grains daily for the following month the intermenstrual interval increased to twenty-nine days and the amount of

flow was appreciably diminished. With the continuation of this dosage, five subsequent periods were normal, and the symptoms of hypothyroidism were relieved. There was a substantial decrease in weight with no dietary restriction.

CASE 4.—A woman at the age of forty-seven had a profuse menstrual flow lasting five weeks. It recurred two weeks later and continued constantly during the next four weeks, at the end of which time she came under observation. Except for a period of amenorrhea many years previously the past menstrual history was not unusual.

For many years she had experienced vague, dull bodily pains which she attributed to neuritis. She was tired most of the time and felt incapable of her work which was not unduly exacting.

Examination revealed nothing of interest except a slight obesity with typical cuffing of fat about the wrists and ankles, a subnormal temperature, and a yellowish appearance of the skin.

After receiving three grains of thyroid substance for a week the flow ceased. Continuation of this regimen resulted in a complete return to normal periodicity and amount of menstrual flow.

CASE 5.—A woman, aged twenty-four years, stated that since the onset of her menses at the age of eleven, they had been profuse, occurring every twenty-one to twenty-five days and usually lasting seven days. The period was accompanied by pain and gastrointestinal disturbance. She had a very poor appetite and complained of loss of strength and energy. She experienced chilliness even during the summer months.

The patient was undernourished and anemic. Both temperature and blood pressure were subnormal. The basal metabolic rate was estimated to be minus 22.

Upon the administration of thyroid extract with a final daily dosage of six grains, the periods became normal in duration and amount of flow, recurring at twenty-five-day intervals. After five months she felt more energetic and was definitely less sensitive to cold.

CASE 6.—A woman, aged fifty-five years came under observation in September, 1929, complaining of attacks of headache, nausea, and vomiting. She felt weak and suffered from vague neuralgic pains. Radium had been used ten years previously to control intractable menorrhagia of five years' duration, and the patient dated the onset of her present illness from that time. The menses had begun at the age of twelve and had been normal until the age of thirty. At that time she had a painful swelling at the base of the neck and was ill with fever for several days. This was apparently acute thyroiditis for pus was obtained by incision into the suprasternal space. After the acute inflammation subsided she gained weight rapidly, became easily fatigued, and was markedly sensitive to cold. At the time her symptoms were attributed to the anemia of menorrhagia, but cessation of the flow was not followed by their improvement.

The patient was an obese individual with puffy eyelids, dry skin, and slight cuffing of fat about the wrists and ankles. The systolic blood pressure was 200, and the diastolic, 120 mm. of mercury. The retinal vessels were markedly sclerosed and renal function was definitely impaired. The basal metabolic rate was plus 5.

She was placed upon a reducing diet and was given vasomotor sedatives in an effort to stimulate kidney function and lower the blood pressure. She appeared to improve under this regimen but temporarily disappeared from observation.

When seen again one year later, her renal impairment seemed definitely worse, the urine being low in specific gravity and containing albumin. She had been vomiting for several days and was moderately edematous.

She responded well to the administration of glucose and fluids and the vomiting soon ceased. In spite of the apparently normal basal metabolic rate, thyroid extract in small dosage was begun. This regimen finally included six grains of the gland

daily and has been continued for four months. She is markedly improved, has lost much weight, and is maintaining a blood pressure below 140 mm. Hg. systolic, and below 100, diastolic.

This patient is undoubtedly one of the type described by Gardiner-Hill and Smith, in whom menorrhagia of the climateric was due to myxedema, and for which the use of radium was proved to be irrational in the light of later developments in the case.

COMMENT

The purpose of this discussion is to direct attention to the occurrence of a phenomenon which has been not infrequently reported, but which apparently has not been sufficiently emphasized. While it is not within the scope of this article to deal with the entire problem of the etiology of menorrhagia, it is to be understood that all patients presenting themselves with the complaint of excessive bleeding, especially at the time of the menopause, should receive a thorough and exhaustive examination to detect any underlying pelvic pathology. If necessary, curettement may be performed to secure material for histologic study, for only by such means may insidious malignant growths be successfully combated.

TABLE I. SYMPTOMS OF HYPOTHYROIDISM OCCURRING IN SIX CASES OF MENORRHAGIA

CASE NO.	WEAKNESS	SENSITIVITY TO COLD	DRY SKIN	NUTRITION	NEURALGIC PAINS	BASAL METABOLIC RATE
1	moderate	moderate	moderate	normal	none	minus 2
2	moderate	marked	moderate	normal	none	minus 19
3	moderate	marked	slight	obese	moderate	minus 5
4	marked	marked	moderate	obese	marked	minus 18
5	marked	moderate	slight	poor	mild	minus 22
6	marked	marked	marked	obese	marked	plus 5

There is much evidence in the cases reported herein to justify the assumption that menorrhagia is often due to deficient function of the thyroid gland. The uniform enlargement of the uterus, frequently attributed to small fibromyomas, may be in certain cases only the result of congestion incident to excessive menstrual stimulation. In the determination of thyroid gland insufficiency, the evidence furnished by the estimation of the basal metabolic rate, subject as it is to various influences, is unreliable. A therapeutic test with the administration of thyroid extract should precede the use of more radical measures in obscure cases of menorrhagia. The patient in Case 6 of this series perhaps could have been spared the expense of radiation and the resulting discomfort of artificial menopause had this suggestion been carried out.

It will be noted that in three cases the basal metabolic rate was estimated to be normal. In spite of this negative finding, which has been overemphasized in the interpretation of clinical data, there were, in ad-

dition to menorrhagia, other symptoms indicative of hypothyroidism. Furthermore, the administration to these patients of thyroid substance in dosage toxic to normal individuals was followed by amelioration of symptoms. It can not be denied that the most reliable index of hypothyroidism is the ability of the individual to utilize substituted gland material for her benefit.

SUMMARY

Excessive bleeding is the menstrual disturbance most frequently associated with hypothyroidism, amenorrhea rarely, if ever, occurring when the thyroid gland alone is deficient in function. In patients of any age whose menorrhagia can not be attributed to pelvic pathology, a therapeutic test with thyroid gland administration should be given before more radical measures are instituted.

Definite hypothyroidism may occur in the presence of an apparently normal basal metabolism. The importance of the basal metabolic rate has been overemphasized in the diagnosis of variation in thyroid gland activity; disturbance of metabolism should be accepted only as one evidence of disease. Clinical acumen remains the principal agent of the physician in the detection of thyroid disturbances and can not be supplanted by any laboratory procedure. The response of the symptoms of hypothyroidism, including menorrhagia, to substitution therapy furnishes the most reliable evidence that the thyroid gland is deficient in function.

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Meyer, Lackner, and Schochet: Paroxysmal Tachycardia in Pregnancy. J. A. M. A. 94: 1901, 1930.

Report of two cases of tachycardia associated with pregnancy. The one showed definite evidence of early decompensation and symptoms pointing to mitral stenosis during an attack in the sixth month of pregnancy. It was deemed inadvisable to submit her to the test of labor and a cesarean section was done at term.

The other patient had been observed at various times in the hospital with attacks of tachycardia lasting from three hours to two days. Two days postpartum another severe attack occurred, with a pulse rate up to 200 for eight days.

The recognition of paroxysmal tachycardia in pregnancy should put the obstetrician on guard as to its possible recurrence during labor. The decision as to time and method of terminating pregnancy is to be determined in each case by evaluating as far as possible the condition of the myocardium, duration, and severity of previous attacks.

GROVER LIESE.

THE INDUCTION OF LABOR AT TERM*

BY J. MORRIS SLEMONS, M.D., LOS ANGELES, CALIF.

(From *The Hospital of the Good Samaritan*)

THE title I have chosen is more comprehensive than my report deserves. Nothing will be said of packs, bags, bougies, or of any other method of induction than the one I have employed successfully during the past four years. This method consists in the rupture of the membranes and the intranasal application of pituitary extract after the preliminary administration of castor oil and quinine. Each of these steps is a familiar procedure, used independently to bring on labor. Each proves quite satisfactory, when effective; but one cannot predict when it will be so. On the other hand the three procedures employed in succession may confidently be relied upon. This combination has not failed in my experience, but to attain success in two cases the treatment was repeated within twenty-four hours.

In September, 1927, I found it expedient to induce labor in a multipara, normal in all respects. Accordingly she entered the hospital at a specified time and took the customary dose of oil and quinine. After the lapse of four hours labor had not begun and I sought to improve the chances of success by applying pituitary extract to the nasal mucosa employing Hofbauer's¹ technic. The extract excited rhythmic uterine contractions at intervals of five minutes but their effect upon the cervix was slight. Consequently, I decided to rupture the membranes. This was accomplished readily, for the cervical canal admitted two fingers before any attempt at induction was made. After the membranes had been ruptured and another pledget of cotton saturated with pituitary extract had been inserted into the nostril, the clinical picture changed very promptly. Vigorous uterine contractions began and recurred at two-minute intervals. The cervix dilated rapidly. The short second stage ended spontaneously. Less than two hours passed from the rupturing of the membranes until the infant was born.

Similar experiences soon convinced me that the rupture of the membranes was an essential step in the induction though alone it was insufficient to inaugurate the mechanism of cervical dilatation with desirable promptness. This procedure, I have since learned, was advocated by Thomas Denman² in his textbook on Midwifery published in 1802.

Delay often follows when spontaneous rupture of the membranes becomes the initial symptom of the onset of labor. Days, a week, or even a longer period will pass occasionally before uterine contractions begin. During this interval an infection dangerous to the mother and at times

*Read before the Los Angeles Obstetrical Society, April, 1931.

fatal to the child³ may gain entrance into the uterine cavity. Therefore, the likelihood of such a complication must be taken into account when the membranes are ruptured deliberately to bring on labor. If a long delay attends the procedure, it is open to serious objection. To avoid that difficulty, oil and quinine are given as a preliminary measure and pituitary extract is administered later.

What intervals of time should be allowed to elapse between the various steps of the method? Experience alone can answer this question. With no field of study other than private practice it has required nearly four years to make the number of observations requisite for sound conclusions. Meanwhile, Doctor Delbert Jackson⁴ of Boston anticipated my report. Omitting the initial dose of oil and quinine, Jackson recommended the rupture of the membranes, followed within twenty to thirty minutes by the hypodermic administration of two to five minims of pituitary extract. Eighty-seven cases comprising 26 primiparae and 61 multiparae were reported. There was no maternal mortality but ten fetal deaths occurred in the series. Five of the infants were macerated, four others premature and one an anencephalic monster.

The method I have used was employed in 132 cases of which 100 were multiparae and 32 primiparae. There have been no maternal deaths. One baby was stillborn and this result, I feel, should be charged against the method as no other cause of death could be proved. In this instance the mother, a primipara, twenty-eight years of age, was eleven days beyond her expected date. The head was deeply engaged. The heart sounds were audible during the early part of the first stage but could not be heard when the cervix was approximately two-thirds dilated. An additional two hours were required before full dilatation was reached. Delivery was effected by forceps. There was a coil of cord tightly wound about the neck and the body was covered with freshly passed meconium leaving no doubt that death had occurred recently. While compression may have shut off the umbilical circulation, it seems wiser to attribute the fatality to vigorous uterine contractions which impaired the placental circulation. This attitude may serve to prevent repetition of the accident. Indeed, the watchfulness inspired by this fatality has probably prevented two or three similar accidents already, for as a precautionary measure the cotton is now withdrawn more promptly whenever the contractions are violent. The opportunity thus provided to control its absorption is precisely what recommends the intranasal administration of pituitary extract.

From first to last the steps in this method of bringing on labor follow familiar lines. The dose of two ounces of castor oil and ten grains of quinine given primarily has never had an injurious effect upon the fetus and only in one instance caused discomfort to the mother. The sensitiveness of this individual to quinine was manifested by a typical rash which disappeared within forty-eight hours. Another patient, aware of this

idiosyncrasy, warned us; and the drug was not given, without lessening the efficiency of the method. In view of this result we are curious to know whether quinine may always be omitted. As yet I have not sought the answer, because I wished to establish first the dependability of the method originally devised and to become familiar with the clinical phenomena which followed its use.

Four hours after oil and quinine are given the membranes are ruptured. This interval of time was chosen because formerly when depending upon these drugs alone for the induction of labor, a method which failed in one-third of the cases, I noticed that effective uterine contractions frequently began at the end of four hours, seldom earlier. It is certain that a longer period may be allowed to pass without discounting the efficiency of the method but nothing is gained by delay. Indeed, the shorter the interval the more acceptable it will be to everyone concerned, and I suspect that two or three hours will ultimately be found sufficient, though here again I have not studied trifling variations from the original schedule.

Unless some complication of pregnancy demands haste, the character of the cervix should be favorable to rupture of the membranes before this method is employed. As I have never dilated the canal to facilitate induction, there has been no occasion to use an anesthetic. My practice is to request patients to return for a weekly examination and postpone induction until the internal os will admit two fingers. The length of the cervical canal is irrelevant to a successful result.

When rupturing the membranes, the possibility of prolapse of the cord should never be forgotten. This accident has not happened to me and may always be avoided, I believe, if the vaginal manipulations are gentle and do not displace the head. Firm pressure made on the fundus by an assistant has proved to be a valuable prophylactic measure. The need for precaution requires emphasis, I am sure, for once or twice I have found a hand prolapsed beside the head even before attempting rupture of the membranes, and have succeeded in pushing the part up before it became jammed tightly in an undesirable location.

Though some familiar implement like a tenaculum, toothed clamp or nasal applicator will rupture the membranes, I have found less awkward, two instruments designed for the purpose. The one devised by Doctor David S. Hillis⁵ of Chicago serves admirably when the membranes are closely applied to the head. Wilson's amniotic trocar,⁶ a sharper tool with protected point, is preferable, if the bag of waters pouches into the cervical canal, a phenomenon more common in primiparae. The escape of fluid corroborates the fact that the membranes have been ruptured and only a small quantity serves this purpose. A large quantity, while unobjectionable, has no special advantage.

After the membranes have been ruptured, certain routine observations of a reassuring nature should be made. It is desirable to check the fetal

heart sounds, to ascertain by abdominal palpation the relation of the head to the pelvic inlet, and to note the degree of uterine retraction following the escape of amniotic fluid. Careful study may reveal conditions unfavorable to the use of pituitary extract: but I have never encountered them. In general one prepares immediately a small pledget of cotton which will fit the nostril, fastens to it a piece of string to facilitate its ultimate removal and saturates the cotton with pituitary extract. One ampule is absorbed by a pledget of convenient size which may be introduced with an ordinary mosquito clamp, but the typical nasal forceps is preferable. Following the path of least resistance, the pledget is lodged between the septum and the inferior turbinate.

Of course the use of pituitary extract is not always required. Oil and quinine with, or without, rupture of the membranes will often suffice. J. Whitridge Williams⁷ comments upon this fact in the last edition of his textbook.

The elimination of the routine administration of pituitary extract in the practice of Williams, has been discussed at his request in an able essay by Guttmacher and Douglas⁸ after a comparative study of that method and the one I proposed. In other words, they record two series of cases; with one, pituitary extract was used, while with the other it was not. The latter group of patients experienced a longer delay between the time of rupturing the membranes and the onset of uterine contractions. Labor, too, advanced more sluggishly. The modification suggested, which I admit to be in the direction of simplicity and also a safeguard toward keeping a powerful oxytocic out of incompetent hands, would seem to mean the sacrifice of time and certainty, a sacrifice that would be justified were the intranasal use of pituitary solution harmful.

If the obstetrician be competent and conscientious, the method I have proposed will not offer difficulty nor prejudice the successful termination of labor. The technic is simple and the dosage of pituitary extract may be controlled by withdrawal of the cotton, thus minimizing the risk of tetanic contractions. This risk has passed in any case half-an-hour after the application was made. Continuous supervision for so brief a period provides effective insurance against accidents attributable to medication. And the treatment may be used as safely in all cases as in those which progress unsatisfactorily. When pituitary extract is employed, the time saving factor, not unacceptable to the patient, becomes apparent. The total length of labor in the case of multiparae in my series was from two to five hours and in primiparae from four to eight hours. Guttmacher and Douglas found that "the length of labor in multiparae was only one-half as long when pituitrin was given." The primiparae, they observed, experienced labors averaging approximately ten hours whether pituitrin was used or not; but the delay between the rupture of the membranes and the onset of pains, an interval they designate the latent period, was twice as long if pituitrin was omitted. Except in a few

instances in which nasal abnormalities were found to explain a meager absorption of pituitrin the "latent period" in my experience was too short for separate consideration, and arbitrarily, perhaps, I have estimated the duration of labor as the period elapsing from the time when the membranes are ruptured until the placenta is expelled.

Before attempting to anticipate and answer pertinent questions regarding the course of labor, the delivery, the placental stage, and the puerperal period, I should say something of the character of my material. Multiparae predominate because with them parturition is generally simpler. Consequently, at first I tried to keep on safe ground while feeling my way and excluded primiparae. Again, dilatation of the cervix begins prior to the onset of labor more frequently in multiparae. However, the same phenomenon occurs in the first pregnancy more often than I supposed until my interest in this problem led to systematic observations: 32 primiparae are included in the series.

In many instances the method was employed after the expected date had passed but more frequently preliminary to it by a period of from one to three weeks. The more premature cases were complicated with albuminuria but fortunately even there the degree of prematurity did not prove to be a serious handicap. Except in the case of the intra-partum death already mentioned, the infants not only were born alive, weighing from five to nine pounds, but progressed normally while under my observation. At the end of six weeks, they were all found well-nourished and healthy. There was nothing in their appearance at birth or subsequently to suggest that the method was at all harmful. Twins were encountered twice; in each instance version was performed on the second child without difficulty. Breech presentations were treated in the customary way. Posterior occipital presentations rotated anteriorly with wonted frequency; only two of 27 posteriors rotated into the hollow of the sacrum.

The course of labor may be shortened by the procedure though it is not recommended for that purpose. I am now describing a method for the induction of labor, not for its management. Nevertheless, we should know that the character of labor is not influenced adversely. And this fact may be accepted confidently on the basis of the material already studied.

The duration of labor, as I have said, has been reckoned from the time when the membranes are ruptured to the expulsion of the placenta. Usually uterine contractions begin shortly after the nasal application of pituitary extract but they may escape the notice of the patient until fifteen to thirty minutes have passed. The first symptom is described ordinarily as slight discomfort in the back resembling a "menstrual cramp." This returns at intervals of five to ten minutes, coincident with contractions. The pains increase gradually in frequency and strength while cervical dilatation advances rapidly in most cases. To gather pertinent data of scientific, rather than therapeutic, interest,

rectal examinations were made frequently. Generally the cervix became effaced at the end of an hour; one-half the required dilatation was accomplished within two hours and full dilatation after a period of two and one-half to four hours. The second stage also proceeded rapidly and terminated spontaneously in 89 of the multiparous women. There were three breech presentations. Low or midforceps were used seven times. Version in addition to its use with two cases of twins was performed once. Among the primiparae there were 15 spontaneous deliveries, 15 low to midforceps, one breech, and one version and extraction. The indications for operative delivery differed not at all from those customary in routine practice.

With regard to its pharmacologic action when pituitary extract is administered intranasally, a few observations are noteworthy. Atypical experiences of two kinds were encountered, namely, a violent action on the one hand and a sluggish one on the other. In five instances within ten minutes following its administration the uterus contracted tetanically and the fetal heart sounds, though distinct, became slower. Without doubt this phenomenon was a sign of danger; and the plug of cotton was promptly withdrawn. Then the uterus relaxed slowly, rhythmic contractions became established and labor proceeded without further complication; in all these cases living children were born spontaneously.

More often the pituitary extract acted sluggishly, a phenomenon almost certainly explained by some interference with its absorption. Indeed anatomic peculiarities of the nose have been demonstrated. Obliging rhinologists* have been kind enough to make the necessary examinations. Some of the patients gave a history of operation upon the nose and the resulting scar tissue obviously would impair absorption. Again deflected septa or spurs productive of atrophic changes in the mucosa were found. It is my impression that the architecture of the nose affects the rate of absorption of the pituitary extract and influences its action, thus becoming a fundamental factor in the rapidity with which labor is brought on. Striking illustrations of the sluggish action were given by two patients who did not respond to the induction procedure on a given afternoon, yet did respond, though tardily, the following morning when it was repeated. In each instance an atrophic mucosa probably absorbed little, or none, of the pituitary extract at any time. Success on second trial should be ascribed, I believe, to the oil and quinine, the membranes having been ruptured for a longer period, more favorable to the prompt action of medication.

In the event of poor absorption the dosage of pituitary extract must be increased by the replacement of one plug of cotton with another at suitable intervals. It is not helpful to employ a larger quantity with any given application, for the mucus secreted about the plug of cotton probably limits absorption to a period of twenty or thirty minutes. In gen-

*For these examinations I desire to thank Doctors Harold D. Barnard, Frederick H. Linthicum and C. Harry Montgomery.

eral, one or at most two applications suffice but four to six have been required by a few individuals with nasal abnormalities. It is reasonable to use the nostrils alternately, making a new application when the uterine contractions weaken or appear at gradually lengthening intervals for the period of an hour.

This method of induction has no unfavorable effect upon the third stage of labor. As a rule the loss of blood is small. Measurements have not been made but the estimates recorded range between 150 and 350 c.c. with the majority of cases approaching the lower figure. The placenta separates in from five to fifteen minutes. One abnormality only appeared in the third stage, a postpartum hemorrhage attributed to a large fetus, probably postmature, requiring manual removal of the placenta. The puerperal morbidity was not increased and noteworthy complications occurred in no case during the convalescent period of six weeks.

My report would be incomplete without frankly answering another pertinent question. What has been taken as a fair indication for the use of the method? When the material was reviewed from this standpoint I was surprised at the number and the variety of reasons leading to its employment. Generally, the procedure has been justified on technical grounds; but, after my confidence in its safety was established, I have been influenced by sentimental considerations which often carry great weight with obstetric patients.

At first induction was employed chiefly on account of the nervousness, impatience, discouragement, whatever name one may give the mental attitude, of women who have passed their expected date. In this group there are 35 cases. Five other patients who had experienced "false labor," entered the hospital on account of symptoms which disappeared in the course of twenty-four hours. There were six toxemias with albuminuria and another with glycosuria. Two individuals were formerly tuberculous with the disease now arrested. One patient presented a valvular heart lesion approaching decompensation. Serious discomfort from varicose veins twice justified the procedure. Premature separation of the placenta with a moderate amount of bleeding was treated successfully in two cases, but in a third the bleeding was not controlled by rupture of the membranes and the administration of pituitrin. In the last instance cesarean section with hysterectomy was performed, inasmuch as the uterine musculature presented numerous small hemorrhagic lesions which at times accompany this complication.

Less technical, though not impractical, reasons for anticipating the spontaneous onset of labor related to patients who had previously experienced a precipitate birth and, therefore, were apprehensive of not reaching the hospital in time for medical supervision and care. Without such a history, others living at a distance willingly accepted my recommendation of induction. The acceptance of these casual indications attests my conviction that the method is safe and sound. Nevertheless, if

injudiciously used, there is no doubt in my mind that it will be found unsatisfactory. No one should employ it, unless he has been well grounded in the practice of obstetrics. The procedure is applicable only to selected cases and their selection requires the exercise of mature judgment. When I have recommended it, the patient has been under my supervision during pregnancy and, consequently, I was familiar with the problems her case presented.

Thus far my remarks have purposely been confined to the practical aspects of bringing on labor. However, since the method I propose runs counter to orthodox obstetric teaching, certain comments of a theoretical character which may not be omitted altogether are made briefly in conclusion. I refer to the mechanism of cervical dilatation which is ascribed, almost axiomatically, to the action of a hydrostatic wedge composed of the membranes and the amniotic fluid. This medium, it is assumed, transmits the force of the uterine contractions and pushes aside the cervical barrier of the birth canal. In my judgment, that hypothesis is disproved, as far as negative evidence can do so, by the course of labor following induction by rupture of the membranes. Deprived of the possible action of such a mechanism, 132 cases reported here have suffered no handicap with regard to the first stage and terminated successfully. Nor did the presenting part of the fetus act as a substitute for the hydrostatic wedge. This contingency was kept in mind and excluded by careful, frequent rectal examinations during labor and by the later inspection of the infant's head which presented merely the usual molding and but very rarely a caput succedaneum. The development of cephaloma-toma did not occur in a single instance.

The phenomena associated with the transformation of the cervix were those we accept as normal. First, the canal became effaced with the simultaneous obliteration of the internal os; and subsequently the external os became more and more widely dilated. From beginning to end the mechanism of the first stage may adequately be explained by retraction of the uterus, the rearrangement of the muscle fibers in response to the forces which pull them upward toward the fundus. Whether some other mechanism is invoked when the amniotic sac remains intact, I cannot affirm. But, it is unreasonable to think so. The responsible mechanism in cases where rupture of the membranes has been employed as an initial procedure is also, I believe, the normal mechanism. To my mind the classical explanation of the means by which cervical dilatation is routinely accomplished must be revised.

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AN ANALYSIS OF 158 CASES OF PLACENTA PREVIA*

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AMONG 32,500 labors occurring at the Jewish Maternity Hospital during the twenty-two years, 1909-1930 inclusive, there were 158 cases of placenta previa, an incidence of practically 0.0048 per cent, or one case in 205 deliveries. Of these, 20 cases, or 12.6 per cent, were placenta previa centralis, 37 cases, or 23.4 per cent, were placenta previa partialis, and 101 cases, or 63.9 per cent, were placenta previa marginalis.

Forty-two cases, or 26.5 per cent, were primiparae. One hundred and sixteen cases, or 73.4 per cent, were multiparae. Only one patient gave a history of having had placenta previa in a former pregnancy. One patient, who had a marginal placenta previa, developed antepartum eclampsia. Of the multiparae studied 38 were para ii, 20 para iii, 24 para iv, 13 para v, 5 para vi, 5 para vii, 6 para viii, 2 para ix, 2 para x, and 1 para xi.

The Age Incidence of Patients Was as Follows.—Between the ages of nineteen and twenty years inclusive, there were 8 primiparae; between twenty-one and twenty-five, 23 primiparae and 23 multiparae; between twenty-six and thirty, 8 primiparae and 33 multiparae; between thirty-one and thirty-five, 3 primiparae and 25 multiparae; between thirty-six and thirty-nine, 26 multiparae, and between forty and forty-five, 9 multiparae. The youngest patient was a primipara of nineteen, and the oldest a para xi, aged forty-five years. It is interesting to note that as the parity and obstetric age of the individual increased, the tendency of placenta previa to increase became more apparent.

Onset of Bleeding.—Of the 158 cases studied in which it was stated at what period of gestation the onset of bleeding occurred, in 2 it was first seen at five months, 2 at five and one-half months, 3 at six months, 7 at six and one-half months, 15 at seven months, 5 at seven and one-half months, 31 at eight months, 26 at eight and one-half months, and 67 at nine months of pregnancy. Therefore in 14 cases, or 8.8 per cent, bleeding occurred from the fifth up to the seventh month. In 20 cases, or 12.6 per cent, bleeding occurred during the seventh month. In 57 cases, or 36 per cent, bleeding occurred between eight and eight and one-half months, and in 67 cases, or 42.4 per cent, bleeding took place at term. Profuse hemorrhage accompanied by the usual systemic signs and symptoms of blood loss occurred in 41 cases, or 26 per cent, of which 15 occurred in central, 15 in partial, and 11 in the marginal type of placenta previa.

Presentation.—The proportion of malpresentations among the 158 cases on admission was 17 breech and 13 transverse presentations, a total

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of 30 cases, or 19 per cent, or about one out of every five cases. Twenty-three of the 30 cases were premature deliveries.

Prolapse of Cord.—There is an especial tendency to the production of prolapse of the cord in placenta previa generally produced by the interposed placenta, which hinders the natural presentation and engagement of the head. In our series we had 2 cases.

Laceration of Cervix.—Cervical tears with bleeding that were severe enough to necessitate repair occurred in 12 cases; 10 were unilateral and 2 bilateral. Four followed manual dilation of the cervix and version, and 8 followed version.

The Stage of Gestation When Delivery Occurred Was as Follows.—From the fifth to the seventh month there were a total of 8 cases. From the seventh to the eighth month there were 21 cases, from eight to eight and a half months 56 cases, and at nine months 73 cases. From this it can be seen that in our series, premature labor occurred in 85 cases, or 53.7 per cent, a little more than one-half the cases. Labor followed hemorrhage in 70 out of 158 cases, or 44.3 per cent.

Mode of Delivery.—The various methods of delivery gave the following results:

1. Seven patients delivered spontaneously with one maternal death, or 14 per cent, and no fetal deaths.

2. Artificial rupture of the membranes with spontaneous delivery was carried out in 28 cases of marginal placenta previa with slight bleeding, in 6 of which pituitrin had been used, with no maternal and no fetal deaths.

3. Braxton-Hicks bipolar version was performed in 4 cases, with one maternal death, or 25 per cent, and one fetal death.

4. A modified de Ribes' bag was introduced extraovularly in 74 cases and intraovularly in 3 cases. In 40 cases, or 39 per cent, the bag was used in marginal, in 32 cases, or 86 per cent, in partial, and in 5 cases, or 25 per cent, in central placenta previa. In 3 of these cases a large bag was introduced immediately after the expulsion of a small bag. Following the expulsion of the bag, 24 of the patients in the marginal and partial group delivered spontaneously after artificial rupture of the membranes. Ten of these patients had been given pituitrin. There was one maternal death, and five fetal deaths, one of which was non-viable. One patient in whom a bag was introduced died undelivered. Eight delivered by breech with no maternal and 2 fetal deaths. In the remaining 44 cases the bag was employed as a preliminary step in the treatment, and following its expulsion or removal 9 of these patients were delivered by forceps with no maternal and 2 fetal deaths, and 35 by internal podalic version (*two of which required subsequent craniotomy on the after-coming head and two a forceps on the after-coming head*) with 2 maternal and 11 fetal deaths. In 6 of the cases the cervix and vagina were packed with gauze. This stimulated the uterus to

contract, to soften the cervix, and to dilate it sufficiently to permit the introduction of a bag. Altogether in this series of 77 cases, there was a total of 4 maternal deaths, or 5.2 per cent, and 20 fetal deaths (one of which was nonviable), or 28 per cent.

5. Internal version was performed on 19 patients. The membranes were ruptured artificially in all. There were 3 maternal deaths, or 16.6 per cent, and 5 fetal deaths (one of which was nonviable), an incidence of 29 per cent. On 7 of these an accouchement forcé followed by version and extraction was performed; 6 of these occurred in the period 1909-1912; the seventh in 1922. Two were in central, 2 in partial, and 3 in marginal placenta previa. This resulted in 2 deaths, one occurring in 1909, and the other in 1922.

6. Forceps were employed in 5 cases with no maternal and one fetal death.

7. There were 7 cases of breech presentation. In this series there were no maternal deaths and two fetal deaths, or 40 per cent.

8. Classic cesarean section was performed on 10 patients, 9 in central placenta previa and 1 in marginal placenta previa. Of these, 3 were primiparae and 7 multiparae. Six were at term, 3 in the last two weeks of pregnancy, and one at six and a half months. There were 3 deaths in this series, all multiparae, giving a maternal mortality of 30 per cent, and 2 infant deaths after delivery, or 20 per cent, and one stillborn on a nonviable baby. Maternal deaths occurred in the following operative cases:

CASE 1.—Admitted in 1928. Age thirty-three. Para iv. At term. History of 2 previous stillbirths. Marginal placenta previa. Transverse presentation. History of bleeding at home for two days. Observed in hospital for twenty-four hours. Not in labor. Sudden profuse hemorrhage. Classic cesarean section. Spinal anesthesia. Died of hemorrhage and shock two hours postpartum, while being prepared for blood transfusion. Baby died two hours postpartum. That death was caused by shock and hemorrhage in this case might possibly be explained by failure to pack the uterus, and by the use of spinal anesthesia which might have been a contributory factor due to splanchnic dilatation following the lowering of the intraabdominal pressure.

CASE 2.—Admitted 1912 as emergency case. Para iv. Age thirty-seven. At term. Central placenta previa. Bleeding profusely on admission. In shock. Not in labor. Cervical dilation one finger. Classic cesarean section one-half hour later. Died from peritonitis on fourth day postpartum.

CASE 3.—Admitted 1925. Para iv. Age forty. Eight and a half months pregnant. Central placenta previa. History of bleeding at home for twelve days. Not in labor. Cervical dilation one finger. In shock. Classic cesarean section two hours after admission. Baby died twenty-four hours postpartum. Mother died from peritonitis on the ninth day postpartum.

In both instances the cause of death was ascribed to peritonitis. In each case the patient had been admitted in a condition of shock. No blood transfusion was given prior or subsequent to operation. The resistance of the patient might have been raised if a transfusion had been given and thereby possibly improved her chances of recovery.

9. In analyzing the treatment of central placenta previa in our series of 20 cases I found that 11 were treated by the vaginal route. (All these cases treated per vaginam occurred in multiparae.) Of the vaginal cases 2 patients were treated by Braxton-Hicks bipolar version with no maternal and one fetal death; 1 patient, treated by bag, died undelivered; 4 patients were treated by extraovular insertion of bag and version, with no maternal and 4 fetal deaths; and 4 patients were treated by internal version (in one of whom the cervix was manually dilated) with 3 maternal and 3 fetal deaths. The cause of death in the 3 maternal cases thus treated was puerperal infection. Only one of these patients received blood transfusion. Two of these cases were complicated by phlebitis. One patient died on the fifth day, one on the thirty-fifth day, and one on the forty-fifth day postpartum. The patient who died undelivered was admitted in 1923. She was a para ii, aged twenty-seven. History of bleeding at home for three weeks. Admitted as emergency case. Central placenta previa. At term. In labor. Cervical dilation two fingers. Stillborn. Moderate shock. Introduction of number 5 bag one hour after admission. Died intrapartum four hours and fifteen minutes after admission from hemorrhage and shock. No blood transfusion given. Temporizing too long at home, and then the desire to empty the uterus rapidly without preliminary treatment of hemorrhage and shock may be held to be the causes of death in this case. The total maternal mortality in this group treated by conservative delivery from below was 4 cases, or 36.3 per cent, and the fetal mortality (the duration of pregnancy having been thirty-six to thirty-eight weeks) was 8 cases, or 80 per cent. Of the 8 fetal deaths, one was stillborn on admission, 4 were stillborn following treatment, and 3 died four hours after delivery. The maternal mortality of the 9 patients (3 of whom were primiparae and 6 multiparae) delivered by abdominal cesarean section was 2, or 22 per cent. Both deaths occurred in multiparae. The fetal mortality was 22 per cent. If we deduct the one stillbirth which occurred in a nonviable child, we have a corrected mortality of 11 per cent.

Management of Placenta.—In 106 cases the placenta was delivered spontaneously. In 7 cases the Credé method was used. In 35 cases, or 23 per cent the placenta was removed manually. This does not include cesarean cases.

Maternal Morbidity.—The total maternal obstetric morbidity was 21 per cent. Puerperal fever developed in 8 patients following cesarean section, in 11 patients after version, in 2 after forceps deliveries, in 8 after bag-version, in 4 after bag-spontaneous, and in 1 after bag-forceps. The temperature ranged between 101° and 103° F. for an average of eight days. Three cases were complicated by a unilateral phlebitis; one patient having fever for forty-five days, and another with a bilateral phlebitis had fever for thirty-eight days. One patient developed a bilateral pyelitis.

Maternal Mortality.—The total maternal mortality among the 158 cases was 12, or 7.5 per cent. From 1909 to 1915 inclusive there were 6 deaths, from 1916 to 1920 one death, from 1921 to 1925 four deaths, and from 1926 to 1930 one death. Four cases occurred in marginal placenta previa with a mortality of 3.8 per cent, 2 in partial placenta previa with a mortality of 5.4 per cent, giving a combined mortality of 6 cases, or 4.3 per cent, in the incomplete variety. Contrasted with these figures the maternal mortality of complete or central placenta previa was 6, or 30 per cent.

In the fatal cases death occurred after the following maneuvers: 1 after spontaneous delivery, 1 after Braxton-Hicks bipolar version, 1 after bag induction, the patient dying undelivered from hemorrhage and shock; 1 after bag-spontaneous, 2 after bag and version (in 1 the cervix was manually dilated), 3 after internal version (in 1 the cervix was manually dilated), and 3 after classical cesarean section.

The causes of death were: peritonitis, 2; hemorrhage and shock, 5 (3 died from postpartum hemorrhage); and puerperal infection, 5.

An analysis of the 5 deaths not previously discussed shows that 2 occurred in partial and 3 in marginal placenta previa. One patient of the partial type, a primipara, seven and a half months gravid, who had been bleeding for two weeks before admission, was treated by vaginal packing, bag and version, followed by manual removal of the placenta. She died on the fourth day postpartum from puerperal infection. No blood transfusion was given. In the other case, a primipara, eight and a half months gravid, who had been bleeding for two weeks before admission, a bag was introduced, followed by manual dilation of the cervix, and craniotomy on the after-coming head. The placenta was removed manually. The cervix was found lacerated. She died on the sixteenth day postpartum from puerperal infection. The 3 patients with marginal type placenta previa died of postpartum hemorrhage and shock. None of them received blood transfusion. One was treated by Braxton-Hicks bipolar version and died within three hours of delivery. The uterus had been insufficiently packed. Another was treated by bag and delivered spontaneously. The placenta was removed manually. The uterus was not packed. Patient died two hours after delivery. The third patient delivered spontaneously. An adherent placenta was removed manually four hours after delivery. The uterus was packed. The patient died from hemorrhage and shock seven hours postpartum. The cervix was inspected in each of the three cases just cited and was found intact.

From a study of the 12 maternal deaths, one can see that accouchement forcé and failure to pack the uterus after delivery accounted for some of the death. Nine of the 12 patients did not receive blood transfusion in our series from 1909 to 1925. A timely blood transfusion would undoubtedly have saved many of the patients. Since 1926, out of 25 cases only one was lost. This low mortality is, I believe, due in a great measure to early blood transfusion.

Fetal Mortality.—An analysis of the fetal deaths showed that 46 infants, or 29.2 per cent, were stillborn. Of these, 16 infants, or 10 per cent, were stillborn on admission. Four were nonviable, 9 were premature, and 3 were full term. There were 30 infants, or 19 per

cent, stillborn following treatment. Three were nonviable, 16 were premature, and 11 were full term.

Twenty babies died from half an hour to ten days after delivery. One was nonviable, 15 were premature, and 4 were full term. The greater number of premature babies died within twenty-four hours after delivery. Of the full-term babies, 1 died from purpura on the eighth day; 1 died from pneumonia on the tenth day, and 1 died from inanition on the sixth day.

The infant mortality for viable infants was 36.7 per cent. The total fetal mortality was 66 cases, or 41.7 per cent. If we deduct the 16 still-born cases where the fetal heart was absent on admission, we have a fetal mortality of 31.6 per cent.

Treatment.—In discussing the treatment of placenta previa there are definite cardinal principles involved which one must observe and adhere to if we are to get satisfactory results. The first question of importance in any method of treatment is the maternal mortality. One should also take into consideration the parity of the patient, the number of living children, the viability of the child, the type of placenta previa he is dealing with, the degree of bleeding, the amount of dilation of the cervix, and whether the patient is in labor.

In the majority of hemorrhages studied, our records revealed that there had been a warning hemorrhage for days or weeks previously. In other instances the bleeding was slow but long continued. The natural inclination is to temporize. Hemorrhage and sepsis are the commonest causes of death. If the patient escapes these, she is left so exhausted that she is less able to resist morbid influences, which render her especially liable to many complications and a prolonged convalescence. And, since the treatment of placenta previa is primarily one of hemorrhage, and there is no treatment except delivery which will stop the hemorrhage, then it must at once become apparent that temporizing exposes the patient to too many risks. The fetal mortality is enormous. This fact must also be carefully borne in mind with a view to treatment, especially as the great majority are premature and do not survive.

Therefore, as soon as placenta previa is suspected, be the bleeding great or little, avoid doing a vaginal examination at home unless one is prepared to pack the vagina with iodoform gauze. The patient should then be immediately transferred to a hospital, for the hemorrhage may at any time recur and become serious. Here, she may be observed for a short period only if the bleeding is slight and the child is near viability; otherwise the case should be terminated at once no matter what the period of pregnancy.

On admission to the hospital, note the temperature, pulse, respiration, and blood pressure. The pulse is taken every fifteen minutes thereafter, and the systolic pressure recorded at least once every half hour. A blood count should be made, the hemoglobin estimated, and a speci-

men of blood taken to be typed and matched for possible blood transfusion.

When vaginal examination for diagnostic purposes is done, it should be conducted under strict aseptic precautions, and only after one is prepared to treat the case immediately. The danger lies first, in the fact that it will disturb blood clots which have already checked the hemorrhage and thereby cause fresh bleeding, and second, in the possibility of introducing bacteria into the placental sinuses.

If on admission the patient shows evidence of shock and collapse, this condition should be treated first, and labor if it has not already begun is induced later. Administer $\frac{1}{4}$ to $\frac{1}{2}$ grain of morphine by hypodermic. Pack the vagina tightly with 5 per cent iodoform gauze. Place the patient in the Trendelenberg position. Inject 1000 c.c. of normal saline solution by hypodermocentesis beneath the breasts. If a donor is not available give an intravenous infusion of saline or glucose solution. Arrange for transfusion as soon as donor can be secured.

Shock following blood loss will frequently lead to complications and death. It must be combated vigorously. Whenever possible, defer operative procedure while the initial shock exists, and until the systolic blood pressure has risen to 90 mm. of mercury or above.

Blood transfusion when given early offers one of the most effective agents to combat loss of blood, lessens the tendency to further hemorrhage, increases the contractile power of the uterus, raises the blood pressure, and slows the pulse. Even the acute anemia, high morbidity, and delayed convalescence incident to hemorrhage can and should be prevented to a great degree by the proper use of this measure. Taking cognizance of this important point we have made every effort during the past five years to use blood transfusion routinely on all our cases.

In patients with marginal and partial types of placenta previa with slight bleeding and the cervix well dilated, and the presenting part engaged, the membranes should be ruptured, a very tight abdominal binder applied, and the patient should be given a small dose of pituitrin, 2 to 3 minims, which will expedite the labor and effect a spontaneous delivery. When bleeding is excessive at the time of rupture of the membranes and the cervix is sufficiently dilated, a version should be done.

In the following type of case I believe the best results have been obtained by employing the conservative method. In patients with the marginal and partial types of placenta previa when the bleeding is slight or moderate and the cervix admits two fingers, labor is induced by the extraovular insertion of a modified de Ribes' bag No. 4 or 5, almost as a routine. This excites pains, dilates the cervix, and controls the hemorrhage. The patient is kept in the operating room, as the bag is usually expelled into the vagina within a short time. In the cases where a small sized bag has been used, one should be pre-

pared to introduce a larger one if necessary. Since hemorrhage may or may not occur, it is advisable that the operator remain with the patient until she is delivered and absolutely out of danger. After the largest bag has passed the cervix, then rupture the membranes. If there is no bleeding and the vertex comes down to exert pressure upon the lower uterine segment and the edge of the placenta, allow the patient to deliver herself spontaneously, aided possibly by a small dose of pituitrin, or expedite the delivery with forceps if necessary. On the other hand, if, following the rupture of the membranes, bleeding is profuse and the vertex does not come down and the cervix is dilated enough to admit the hand, then perform a podalic version. Since manual dilation of the cervix invariably results in manual laceration, this procedure should be condemned. After a leg has been brought down, the labor is allowed to terminate naturally, extracting the child gradually. Although we have had no personal experience with rupture of the lower uterine segment as a complication, nevertheless it should be guarded against.

Every effort is made during the entire delivery to prevent bleeding and shock. As previously stated, it is considered good judgment to transfuse all patients when indicated before or coincident with active delivery, and retransfuse after delivery when necessary.

If there is no bleeding following the birth of the fetus, wait for the placenta to separate naturally; but if the bleeding still continues, use Credé's method, and if it is not effective, remove the placenta manually.

In every case of placenta previa as a precautionary measure the uterus should be packed tightly with 5 per cent iodoform gauze through a tubular packer and the pack allowed to remain for three or four days.

If when the cervix is inspected, it is found lacerated and if the bleeding continues, it should be repaired.

The vagina is packed with iodoform gauze. Pituitrin and gynergen are given by hypodermic injection to maintain contraction of the uterus. The fundus should be watched carefully for a period of several hours after the third stage to maintain contraction of the uterus. Not infrequently, relaxation of the uterus or bleeding from the placental site in the lower noncontractile uterine segment will occur, resulting in a serious and possibly fatal hemorrhage.

In complete or central placenta previa when the cervix will admit two fingers, extraovular insertion of the largest size bag is advantageous in the average case. Following the expulsion or removal of the bag the hand is introduced into the uterus and a leg brought down. However, in central placenta previa one should individualize his case. Regardless of the parity or period of gestation, abdominal cesarean section must always have its place.

In the serious emergency cases in which patients are admitted practically exsanguinated from loss of blood, and subjected to conservative or radical operative measures which will only help further to increase the existing prostration and shock, it is a question whether it may be possible for a patient to survive, unless we first combat the shock with morphine and blood transfusion. Following the reaction, the patient should be delivered and retransfused if necessary.

Central placenta previa has the greatest maternal and fetal mortality. Every effort should be made to reduce both. From a comparative study of our own results obtained in 20 cases treated by conservative and radical measures, we must conclude that active treatment gives much better results for both mother and child. For this reason, under certain conditions, I would favor abdominal cesarean section as the operation of choice in all primiparae having a closed or slightly dilated cervix, at or near full term, with a living baby, and the mother in good condition. In multiparae, provided the patient complies with the above indications, one may expose the mother to an additional risk of operation, if she desires a living baby.

In reviewing statistics I find that there is as yet no unanimity of opinion with regard to this operation, although in recent years more clinics have been resorting to section in central placenta previa than heretofore, and the results seem fully to justify this procedure.

CONCLUSIONS

1. Both maternal and fetal mortality can be considerably reduced if proper supervision of all bleeding cases be given early, while the patient is in good condition, rather than attempt to temporize too long.
2. All vaginal examinations should be avoided, unless one is prepared to treat the case immediately, for it may result in severe hemorrhage difficult to control.
3. Every effort should be made to conserve blood and combat shock. If shock and hemorrhage are present, they should be treated first and labor induced if pains have not begun.
4. Manual dilation of the cervix followed by version and extraction gives a very high maternal and fetal mortality, and this form of treatment should be condemned.
5. The routine insertion of a bag extraovularly in marginal and partial cases of placenta previa has given satisfactory maternal results and has lowered our fetal mortality considerably.
6. On account of the very high fetal mortality due to prematurity and prolonged bleeding, the mother should receive first consideration; unless the treatment to be instituted to save the child is not antagonistic and will not imperil the life of the mother.
7. In all types of placenta previa following the expulsion or removal of the placenta the uterus should be firmly packed with iodo-

form gauze so as to favor contraction and retraction of the uterus. Frequently upon failure to observe this rule relaxation of the uterus will occur which will result in a serious and sometimes fatal hemorrhage from one to several hours postpartum.

8. Blood transfusion is indicated on all patients who have a low red blood count, low hemoglobin, and a systolic blood pressure below 90, following hemorrhage and shock. During the past five years since this procedure is being more definitely used as a prophylactic measure in antepartum, intrapartum, and postpartum cases, not only have our maternal and fetal results improved, but the morbidity has been lessened, and convalescence hastened.

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1 WEST ONE HUNDRED AND TWENTY-THIRD STREET

THE CESAREAN SECTION STATISTICS FOR THE CITY OF PORTLAND, OREGON, FROM 1926 TO 1929

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IN RECENT years several articles have appeared dealing with the operation of cesarean section in different parts of the country. To date, no such series has been reported from the Northwest. Feeling that such a study might be interesting an attempt was made to review all cases of cesarean sections done in Multnomah county from Jan. 1, 1926, to Dec. 31, 1929. Every hospital and nursing home where there was any possibility that a cesarean section might have been done was canvassed. Because of the excellent cooperation in all instances, it is believed that practically every cesarean section performed during these years was located. There were in all 217 cesarean operations, of which the charts were personally reviewed in all but nine cases. There were during the same period 19,313 births reported in Multnomah county, an incidence of one section to every 89 births, or 1.12 per cent. In the hospitals where the charts were available for study, there were 208 sections in 10,737 births or an incidence of 1.9 per cent. In reviewing these statistics, it must be remembered that they comprise the results of specialists, surgeons, and general practitioners. One hundred and one cesarean sections were performed by specialists, and 107 by physicians not limiting their work to this field. While there is not space here to enumerate the percentage of indications for each group, it is interesting to note that there is a marked similarity in all but two types of cases. Twelve of the 14 cesarean sections done for eclampsia

were performed by the nonspecialist group. On the other hand, the obstetrician performed 7 cesarean sections for cervical stenosis while his nonspecializing colleague did no cesarean sections because of this condition. In Table I are listed the various indications for which the operation was performed, together with the percentage of each indication. Special comment will be made only on the more important and interesting indications.

TABLE I. SHOWING THE INDICATIONS FOR CESAREAN SECTION IN THE GROUP STUDIED TOGETHER WITH THE PERCENTAGE OF EACH INDICATION

Dystocia (54.9%)	Disproportion (40%)	{	Contracted Pelvis (36.7%)	{	Gen. cont. (14%)	
					Flat (9.1%)	
	Funnel (5.8%)					
	Deformed (3%)					
	Not stated (5%)					
		Excessively large child (3.3%)				
	Abnormal presentations (3.9%)					
	Obstructing tumors (5.6%)	{	Fibroids (4.3%)	Ovarian cysts (1.3%)		
	Cervical rigidity (3.9%)					
Uterine mal-action	{	Tetany (0.5%)	Primary inertia (0.5%)			
Operative displacements of uterus (0.5%)						
Previous cesarean section (7.7%)						
Placenta previa (8.7%)						
Premature separation of the placenta (3.9%)						
Late toxemias of pregnancy (14%)	{	Preeclamptic toxemia (7.2%)	Eclampsia (6.8%)			
To prevent damage to previous repair (1.5%)						
Pulmonary tuberculosis (0.5%)						
Heart disease (1.5%)						
Desirous of living child (1%)						
No indication stated (1%)						

Of the 76 operations done for contracted pelvis, 14 of the patients had had previous cesarean section, 38 were primiparae, and 16 others had had previous stillbirths on attempted vaginal delivery. Twenty-nine of these patients were submitted to a test of labor averaging eighteen and one-half hours.

In 7 instances, the cesarean section was done because of disproportion arising from an excessively large child. The smallest of these weighed 8 pounds 8 ounces, and the largest 11 pounds 8 ounces. The average weight of these babies was 9 pounds 2 ounces. In all 7 instances a test

of labor averaging twenty-three hours was given. Again all 8 cases of cervical stenosis had test labors averaging twenty-seven hours. Seven of these were primiparae while one was a multipara who previously had extensive cervical repairs with scar tissue formation. The youngest of the primipara was twenty-three years of age, the oldest thirty-nine years of age, while the average age of these 7 patients was thirty-one and a half years.

In studying the sections done for hemorrhage, it is interesting to note that the morbidity is increased in this type of case especially where vaginal examination has preceded operation. In the cases of abruptio placentae, the number of postoperative temperature days averaged one day more and in placenta previa two and three-tenths days more in those cases where a vaginal examination had been made.

Finally, it is interesting to study in more detail those operations done for late toxemias of pregnancy. There were 15 cases of preeclamptic toxemia of which 8 received preoperative hospital treatment for an average of seven and a half days. Again 5 of the 14 eclamptic cases received preoperative treatment averaging five hours. Of the 14 eclamptic cases 9 were primiparae, 4 were multiparae and in one case the parity was not stated. Table II gives the complete indications for which these sections were done.

The types of cesarean section employed in this series are shown in Table III. In view of the present predominance of authority favoring

TABLE II. SHOWING THE COMPLETE INDICATION FOR CESAREAN SECTION IN THE PRE-ECLAMPTIC AND ECLAMPTIC GROUP

INDICATION FOR CESAREAN SECTION	PREECLAMPSIA	ECLAMPSIA
Toxemia alone	10	10
Toxemia plus two stillbirths	1	0
Toxemia plus large child	1	
Toxemia plus previous cesarean section	1	1
Toxemia plus elderly primipara	1	1
Toxemia plus contracted pelvis	1	1
Toxemia plus twin pregnancy	0	1

TABLE III. SHOWING THE NUMBER AND PERCENTAGE OF THE DIFFERENT TYPES OF CESAREAN OPERATION IN THE SERIES STUDIED

TYPE OF OPERATION	NUMBER	PER CENT
Classical	148	74.3
Classical plus hysterectomy	5	2.5
Classical plus sterilization	18	9.0
Classical plus myomectomy	5	2.5
Classical plus oophorectomy	2	1.0
Low cervical	8	4.0
Low cervical plus oophorectomy	1	0.5
Postmortem cesarean section	1	0.5
Not stated	10	5.0

the low section, it is interesting to note the comparatively low frequency of this operation in the present series. Inasmuch as all fatalities were following the classical type, it is hoped that a more frequent use of the low operation may reduce the mortality and morbidity.

A study of the morbidity shows that of the complications not resulting in death were 3 wound infections, 3 instances of pyelitis, 3 cases of anemia necessitating transfusion, 2 pulmonary complications, and one case each of liver abscess, phlebitis, pelvic abscess, endometritis, and breast abscess. Aside from these, there were 66 cases showing unexplained temperature for longer than seventy-two hours postoperatively. A more detailed study shows, as others have so often pointed out, that the morbidity is increased by both labor and vaginal examination. The average length of postoperative temperature for those cases done before the onset of labor was three days, for those where labor was less than ten hours, four and seven-tenths days and for those in labor longer than ten hours eight and one-half days. Again the average postoperative temperature days for those cases not having vaginal examinations was four and one-third days as contrasted with seven and one-third days in those cases where there had been a vaginal examination.

Tables IV and V show the cause of fetal and maternal deaths, respectively, together with the indication for which the cesarean section was done, and Table VI gives the mortality percentage of the various indications. In studying Tables V and VI, it will be seen that there were 3 maternal deaths among the 29 cesarean sections done for toxemia. However, it must be stated that one of these was a postmortem cesarean section in which the child was saved. In the other 2 the patients were morbid at the time of the operation and the section was done entirely in the interest of the child. While these latter two must be counted as cesarean section deaths, it is perhaps fair to discount them in figuring the corrected maternal mortality so far as cesarean section in toxemic patients is concerned.

TABLE IV. SHOWING THE DIFFERENT TYPES OF FETAL DEATH TOGETHER WITH THE INDICATIONS FOR CESAREAN SECTION IN EACH CASE

TYPE OF DEATH	INDICATION FOR CESAREAN SECTION
Stillbirths (11)	Premature separation of placenta
	Prolapsed cord
	Tetany of the uterus
	Eclampsia
	Contracted pelvis
Died shortly after birth (5)	Disproportion (hydrocephalus)
	Eclampsia
	Previous cesarean section (Hemorrhage of newborn)
	Placenta previa
Premature (6)	Contracted pelvis
	Eclampsia
	Placenta previa

TABLE V. SHOWING THE CAUSE OF THE MATERNAL MORTALITY TOGETHER WITH THE ORIGINAL INDICATION FOR THE CESAREAN SECTION IN EACH CASE

CAUSE OF DEATH	NO. CASES	INDICATION FOR CESAREAN SECTION
Peritonitis	2	Previous cesarean section 1
		Large child 1
Puerperal septicemia and liver abscess	1	Placenta previa 1
*Eclampsia	3	Eclampsia 3
Hemorrhage and shock	2	Contracted pelvis 1
		Premature separation of the placenta 1
Localized peritonitis and pneumonia	1	Contracted pelvis 1
Pulmonary embolus	1	Fibroid uterus with breech presentation 1

*See text for fuller description.

TABLE VI. SHOWING THE NUMBER AND PERCENTAGE OF MATERNAL AND FETAL DEATHS WHICH OCCURRED IN EACH INDICATION FOR CESAREAN SECTION IN THE SERIES STUDIED

INDICATION FOR CESAREAN SECTION	TOTAL NUMBER OPERATED	MATERNAL DEATHS		FETAL DEATHS	
		NUMBER	PER CENT	NUMBER	PER CENT
Preeclampsia and eclampsia	29	3	10.3	4	13.2
Contracted pelvis	76	2	2.6	4	5.2
Previous cesarean section	16	1	6.3	1	6.3
Placenta previa	18	1	5.5	3	16.6
Fibroid uterus	9	1	11.1	0	0
Large child	7	1	14.3	1	14.3
Malpositions and presentations	6	0	0	1	16.6
Premature separation of the placenta	8	1	12.5	7	87.5
Mal-action of the uterus	2	0	0	1	50.0
Total	217	10	4.6	22	10.1

Among the 217 cesarean sections, there were 10 maternal deaths (4.6 per cent) and 22 fetal deaths (10.1 per cent) or a total mortality of $7\frac{1}{3}$ per cent. On the other hand, if these figures be corrected by subtracting the 3 maternal deaths due to eclampsia where, as has been stated, the cesarean section was done only after the mother was dead or dying, and eliminating the 6 fetal deaths due to prematurity, the maternal mortality is 3.2 per cent, and the fetal mortality 7.3 per cent, giving a combined mortality of 5.3 per cent.

A STUDY OF THE MENSTRUAL HISTORIES OF 2,282 UNIVERSITY WOMEN

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EVERY physician caring for large groups of young women finds dysmenorrhea an important and often baffling symptom. Painful menstruation is obviously only a symptom, the causes of which are varied and complex.

In reviewing the literature on the causes and treatment of menstrual pain, one is impressed with its mass and the widely divergent opinions as to etiology and treatment. One point, however, upon which there is general agreement is that there is still much to be learned about this important problem.

A study of the findings in the menstrual histories and physical examinations of 2,282 University women is presented herewith. A complete physical examination, except for a pelvic examination, was given each student. The following menstrual history was recorded by the student at the time of the examination.

Menstrual history: Age menstruation was begun -----
Amount—small ----- medium ----- profuse -----
 Regular every ----- days
Periods Duration ----- days
 Irregular every ----- days
Discomfort—Yes, no. Pain (days, character)
Miss classes—Yes, no. Go to bed—Yes, no.
Previous treatment for menstrual disorders

The physician discussed with the student any abnormal menstrual symptoms which she had checked in the history and classified her as to menstrual function, each student being placed into one of the following four groups: normal menstruation, dysmenorrhea, irregular menstruation and amenorrhea. Only those students were put in the dysmenorrhea group who gave histories of having more than a mild discomfort at the menses.

INCIDENCE OF DYSMENORRHEA

Analyses which have been made of the incidence of dysmenorrhea show a great diversity of opinion. Reports of patients seen in private practice give a much higher incidence than reports based upon college women. This is probably a natural difference as women consulting a gynecologist do so because of some complaint, while a group of college women are a more or less unselected group of supposedly healthy individuals.

Jacobi,¹ one of the pioneers in the study of dysmenorrhea, in 1877 reported on the incidence of painful menstruation in 128 cases of schoolgirls and older women to whom questionnaires were sent and found it to be 47 per cent.

Sanes,² in 1916, reported on 4,500 menstrual histories of office patients. Of this group he found 47.4 per cent who complained of dysmenorrhea.

In 1920, Meredith³ published a report on functional menstrual disturbances of 749 college girls. She found an incidence of dysmenorrhea of 17 per cent.

Sturgis⁴ found that 34.9 per cent of 2,077 women employed in a department store had menstrual pain.

In 400 private patients, Bell⁵ found 46 per cent with dysmenorrhea and in 600 hospital patients 43 per cent.

Clow⁶ studied the menstrual histories of 2,050 girls, 1,346 in a secondary school and 220 in a teachers' training school. Of the entire group, 22 per cent had dysmenorrhea. In 17 per cent the dysmenorrhea was classified as slight.

Van Duyne⁷ reported on the records of 3,072 women entering Goucher College from 1900 to 1924. She reports the incidence of dysmenorrhea as follows:

1900-1907	37.4 per cent
1917-1923	26.0 per cent
1923-1924	13.4 per cent

Miller⁸ in 1930 reported on the incidence of dysmenorrhea in 785 college women and nurses and found 47 per cent of the group to have painful menstruation.

Table I gives the findings in the menstrual histories of 2,282 women at the University of Minnesota.

TABLE I. MENSTRUAL HISTORY OF 2,282 UNIVERSITY WOMEN

	NUMBER OF CASES	PER CENT
Normal	1562	68.45 \pm 0.7
Dysmenorrhea	465	20.38 \pm 0.6
Irregular	236	10.34 \pm 0.5
Amenorrhea	19	0.83 \pm 0.2
Total	2282	100.00

Of the entire group, 20.38 per cent gave a history of painful menstruation, 10.34 per cent had irregular periods, and 0.83 per cent had amenorrhea. The groups with irregular menstrual periods and amenorrhea will not be discussed further as no significant variations were found.

With the exception of Miller's recent report, the amount of dysmenorrhea found among college women has been much less than that reported for hospital or office patients.

Table II shows the percentage of students who had dysmenorrhea in each age group.

There is a constant increase in the percentage of dysmenorrhea as the age increases up to the 20 year group. The increase from year to year up to 20 years of age is not sufficient to be of significance. However, the difference in the percentage of dysmenorrhea in each age group under 20 years and the groups over 20 years is great enough to be probably significant.

TABLE II. AGE AND DYSMENORRHEA

AGE IN YEARS	DYSMENORRHEA		
	NUMBER OF CASES	PER CENT	DIFFERENCE BETWEEN AGE GROUPS
17 or under	23	11.97 \pm 1.6	
18	74	16.48 \pm 1.2	4.31 \pm 2.0
19	72	17.39 \pm 1.3	0.91 \pm 1.8
20	91	24.14 \pm 1.6	6.75 \pm 2.2
21 or over	205	24.12 \pm 1.0	0.02 \pm 1.9
Total	465	20.38 \pm 0.6	

In Table III the percentage of students having dysmenorrhea have been grouped according to the year in college. A small group of student nurses are included in this table.

TABLE III. THE AMOUNT OF DYSMENORRHEA BY YEAR IN COLLEGE

	TOTAL NUMBER	DYSMENORRHEA	
		NUMBER	PER CENT
Freshmen	742	110	14.82 \pm 0.9
Sophomore	521	127	24.38 \pm 1.3
Junior	378	82	21.69 \pm 1.5
Senior	447	116	25.95 \pm 1.4
Graduate	19	7	22.58 \pm 5.0
Nurses	86	6	6.98 \pm 1.9
	2193	448	

The sharp increase from 14.82 per cent in the Freshmen group to 24.38 per cent in the Sophomore group is of definite statistical significance, the difference being 9.56 per cent \pm 1.9. It is difficult to find a satisfactory explanation for this difference. It is possible that a change from the regularity of home life to the more or less irregular habits of hygiene of many college girls may in part account for this. On the other hand, for many students, college life may require greater regularity in habits of living than were practiced prior to college entrance. It is possible also that Freshmen show more reticence about recording menstrual pain than do the older students.

The group of 86 student nurses are included in this table because of the very low percentage (6.98 per cent) of dysmenorrhea found. The regularity of living and daily physical exercise necessary to this professional group may be partially responsible for the small number having menstrual pain.

Table IV presents the percentage of dysmenorrhea in relation to the size of town in which the student has lived most of her life. There is no significant difference in any of the groups. The very small rural

group seems to have less dysmenorrhea but the number is so small that one is not justified in drawing any conclusions.

Another factor obtained from the history of the student was the relationship between exercise and menstrual pain. At the time of the routine examination, each student was questioned by the examining

TABLE IV. SIZE OF TOWN AND DYSMENORRHEA

SIZE OF TOWN	DYSMENORRHEA	
	NUMBER OF CASES	PER CENT
Less than 50	3	10.34 \pm 3.8
50 - 999	57	19.8 \pm 1.6
1000 - 4999	72	17.02 \pm 1.3
5000 - 49,999	91	21.87 \pm 1.4
50,000+	209	21.28 \pm 0.9
	432	

physician about the amount of exercise taken and classified into one of three groups: no exercise—moderate exercise—excessive exercise.

Table V presents the findings in regard to exercise.

TABLE V. RELATION OF HISTORY OF EXERCISE AND MENSTRUAL PAIN

	NORMAL		DYSMENORRHEA		IRREGULAR	
	NO. OF CASES	PER CENT	NO. OF CASES	PER CENT	NO. OF CASES	PER CENT
No exercise	343	71.01 \pm 1.39	88	18.22 \pm 1.18	51	10.56 \pm 0.94
Moderate exercise	1210	67.67 \pm 0.74	375	20.98 \pm 0.64	185	10.35 \pm 0.49
Excessive exercise	6	85.71 \pm 8.92	1	14.29 \pm 8.92	0	
Total	1559		464		236	

The percentage of cases of dysmenorrhea in the group classified as taking excessive exercise is slightly lower than for the other two groups, although statistically the difference is not significant. This is due to the fact that there is only one case in the excessive exercise group. There is a slightly greater percentage of dysmenorrhea in the group taking moderate exercise than in that taking no exercise. It is an established fact clinically, however, that certain types of dysmenorrhea are distinctly benefited by physical exercise, although in the series presented, exercise or lack of it seems to have no relation to the amount of dysmenorrhea.

RELATIONSHIP BETWEEN POSTURE AND DYSMENORRHEA

There has been an assumption that poor posture is one of the many causes of painful menstruation. However, there has been no real basis for such a belief. Miller's⁸ recent study is a noteworthy contribution to this phase of the dysmenorrhea problem. In his series he found a decrease in the occurrence of dysmenorrhea coincident with improve-

ment in posture and muscle tone. He attributes this improvement to the effects of improved muscle tone on the circulation. As his group of cases without dysmenorrhea showed as much improvement in posture as those with dysmenorrhea, Miller states that the explanation of dysmenorrhea on a basis of posture is complicated and believes that muscle tone is more fundamental than posture.

TABLE VI. POSTURE AND DYSMENORRHEA

	TOTAL NUMBER	NORMAL		DYSMENORRHEA		IRREGULAR	
		NO. OF CASES	PER CENT	NO. OF CASES	PER CENT	NO. OF CASES	PER CENT
A	139	87	59.59 \pm 2.74	33	22.60 \pm 2.33	19	13.01 \pm 1.88
B	920	628	67.89 \pm 1.04	188	20.32 \pm 0.89	104	11.24 \pm 0.70
C	744	526	70.51 \pm 1.13	145	19.51 \pm 0.98	73	9.77 \pm 0.73
D	77	63	81.82 \pm 2.96	7	9.09 \pm 2.21	7	9.09 \pm 2.21
A+B	1059	715	66.76 \pm 0.96	221	20.63 \pm 0.83	123	
C+D	821	589	71.48 \pm 1.05	152	18.45 \pm 0.90	80	

In Table VI the percentage of cases of dysmenorrhea in four posture groups, A, B, C, and D, are presented. The posture ratings were given by the Department of Physical Education for Women and were based upon shadow pictures and a careful examination of the student by a member of the department.

In this series, there was a constant decrease in the percentage of dysmenorrhea as the posture became poorer. In the cases having A posture, 22.6 per cent had dysmenorrhea, while in those having D posture, 9.09 per cent had dysmenorrhea. This difference in percentage is large enough to be of statistical significance in spite of the fact that there were only 7 cases of dysmenorrhea in the D group. When the better posture or A and B groups are combined and the poorer posture or C and D groups are combined, the percentage of dysmenorrhea in the better posture group is slightly higher than in the poorer posture group, although the difference is not significant. It is of interest also to note that only 55 per cent of the normal group fall in the A and B posture classification, while 58 per cent of the dysmenorrhea group are classified as A or B. In this group of cases, it seems evident that posture has no relationship to dysmenorrhea.

RELATIONSHIP OF CERTAIN PHYSICAL FINDINGS TO DYSMENORRHEA

In 1847, Jacobi¹ called attention to the relation between general health and dysmenorrhea. In her series, 36 $\frac{1}{3}$ per cent of the group without menstrual pain had "poor health," while 61 per cent of the dysmenorrhea group had "poor health." The health rating was based entirely upon the patient's history and the number of miles the individual walked per day. Although this was an inexact method of measuring physical fitness, it is interesting that the observation was made that poor physical fitness might have some relation to menstrual pain.

Chisholm,⁹ in 1913, in reporting on the menstrual history of 293 schoolgirls notes the relation between anemia and weight and dysmenorrhea. In 23 cases with a hemoglobin of less than 80 per cent (Tallquist) 56.5 per cent had dysmenorrhea. She found no marked relationship between weight and menstrual pain.

Van Duyne⁷ cites 21 case histories of girls with dysmenorrhea giving certain physical findings. She noted no constant finding in the group except weak abdominal muscles.

In this study, four objective physical measurements were selected. These were systolic blood pressure, height-weight percentage (according to the Medico-Actuary tables), hemoglobin percentage and the vital capacity percentage according to height.

Chart 1 is a graphic representation of the percentage of dysmenorrhea occurring in each of three levels of systolic blood pressure, height-weight percentage, hemoglobin, and vital capacity percentage by height.

Systolic Blood Pressure.—24.14 per cent of the total group with a systolic blood pressure of 109 or less had dysmenorrhea while only 11.95 per cent of the group with a systolic blood pressure of 130 or more had dysmenorrhea. Chart 1 shows a constant decrease in dysmenorrhea as the blood pressure increases. The shaded area of each column represents the probable error of the percentage. It will be seen that the probable error is very small.

The data in Table VII further substantiates this. The mean systolic blood pressure for the dysmenorrhea group is 3.37 ± 0.38 lower than for the normal or group without menstrual pain.

Height-Weight Percentage.—Chart 1 indicates a decrease in the percentage of dysmenorrhea as the height-weight percentage increases. The greatest percentage of cases of dysmenorrhea occurred in the group 10 per cent or more underweight. In Table VII it is shown that the mean height-weight percentage is significantly lower for the dysmenorrhea group than for the nondysmenorrhea group.

Hemoglobin.—The hemoglobin readings were taken with a Tallquist hemoglobinometer. Turning again to Chart 1 it is seen that in the group with a hemoglobin of 69 per cent or less, the percentage of dysmenorrhea is the greatest and that there is a tendency for dysmenorrhea to decrease as the hemoglobin increases. The mean hemoglobin (Table VII) for the dysmenorrhea group is slightly lower than for the normal menstruation group. While the difference in the means is slight, 0.64 ± 0.20 , statistically it is probably significant.

Vital Capacity.—The graph of vital capacity (Chart 1) presents quite a different picture from that of the three preceding factors. The percentage of cases of dysmenorrhea increases slightly as the percentage of vital capacity increases. The mean vital capacity (Table VII) of the dysmenorrhea group is also slightly higher than that of the normal group although this difference is not significant.

It is evident from this data on certain objective measurements of physical fitness that the percentage of young women having dysmenor-

TABLE VII

	MEAN AGE	SYSTOLIC BLOOD PRESSURE		HEIGHT-WEIGHT PER CENT		HEMOGLOBIN		VITAL CAPACITY	
		MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION
Normal	19.4	119.23 ± 0.20	11.56 ± 0.14	98.97 ± 0.20	11.68 ± 0.14	78.56 ± 0.09	5.44 ± 0.07	92.53 ± 0.20	11.64 ± 0.14
Dysmenorrhea	19.8	115.86 ± 0.32	10.23 ± 0.23	96.61 ± 0.35	11.10 ± 0.25	77.92 ± 0.18	5.73 ± 0.13	92.73 ± 0.36	11.60 ± 0.26
Difference of Means		3.37 ± 0.38		2.36 ± 0.40		0.64 ± 0.20		0.20 ± 0.41	

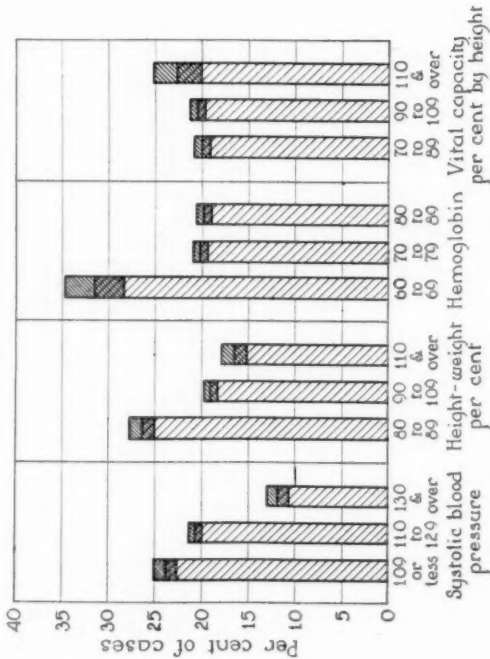


Chart 1

rhea is greatest in the groups having the lowest blood pressure, the lowest height-weight percentage and the lowest hemoglobin percentage.

Nervous Tension.—It is contended frequently that the high strung or nervous woman is more prone to menstrual pain than is the more emotionally stable person. Obviously, it is impossible to obtain objective data to either prove or disprove such an assumption. Physicians examining the subjects of this study checked as "high strung" each individual who appeared emotionally unstable.

TABLE VIII

	HIGH STRUNG		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
Normal	56	57.2 \pm 3.4	1517	52.5 \pm 0.6
Dysmenorrhea	29	29.5 \pm 3.1	1137	39.7 \pm 0.6
Irregular	13	13.3 \pm 2.3	230	7.8 \pm 0.3
	98	100.0	2884	100.0

Table VIII shows that 98 women were classified as "high strung" while 2,884 were not so classified and are therefore used as a control group. The menstrual histories of those described as "high strung" placed 57.30 per cent in the normal group and 29.51 per cent in the dysmenorrhea class, whereas, 52.5 per cent of the control group had normal menstruation and 39.7 had menstrual pain. Thus, the control group showed a significantly higher percentage of dysmenorrhea than did the "high strung" group. It seems evident that those students who were observably "high strung" had not as great a tendency to dysmenorrhea as had those who seemed to have less nervous tension.

SUMMARY

1. The incidence of dysmenorrhea in 2,282 University women was 20.38 per cent.
2. The percentage of dysmenorrhea increased as the age increased up to twenty years of age, with a significant increase between the groups under twenty years and those over twenty years of age.
3. The incidence of dysmenorrhea was lowest in the Freshman year. In a small group of student nurses the percentage of dysmenorrhea was 6.98 per cent compared to 20.38 per cent for the University women.
4. The size of town in which the student has lived has no relation to dysmenorrhea.
5. The amount of physical exercise as reported by the student has no significant relationship to dysmenorrhea.
6. Posture has no significant relation to dysmenorrhea, although the percentage of dysmenorrhea in the poorer posture groups was lower than in those with better posture.
7. The mean systolic blood pressure, the mean height-weight percentage, and the mean hemoglobin percentage was significantly lower

for those having dysmenorrhea than for the group who have no pain. The mean vital capacity percentage was slightly higher for the dysmenorrhea group. The percentage of cases having dysmenorrhea was greatest in the lowest blood pressure group, the lowest height-weight percentage group and the lowest hemoglobin group.

8. The percentage of dysmenorrhea occurring in a group of students who were classified as "high strung" was lower than in a control group not so classified.

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THE OBSTETRIC TRANSVERSE DIAMETER

THE SIGNIFICANCE OF ITS MEASUREMENTS BY X-RAY PELVIMETRY*

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THE commonly employed methods of pelvimetry do not enable us to measure either the anteroposterior or the transverse diameters of the pelvic inlet in a direct manner. Estimates of their length are, therefore, subject to an unavoidable source of error which may be significant whenever the measurements so obtained are shorter than normal. Since there is not even an indirect method of measuring the transverse diameter by internal pelvic examination, an estimate of its length is particularly unreliable as it is based entirely upon the external transverse measurements of the false pelvis. There exists, consequently, a mistaken tendency to think chiefly in terms of the computed true conjugate as indicative of the size of the pelvic inlet; practically all suggestions for the management of labor complicated by contracted pelvis being based on different lengths of this diameter. This fallacy is immediately apparent when one considers that we cannot describe the size of any passageway by mentioning only one of its dimensions.

X-ray pelvimetry provides us with the only means of measuring all the inlet diameters accurately. Its value is evident and assumes added significance because the pelvic inlet far more frequently offers serious obstruction to delivery than does the pelvic outlet. Since its introduction, attention has again been directed to the equal significance of the

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transverse, as well as the anteroposterior diameter, as a measure of the inlet capacity, and in this lies its greatest contribution.

In speaking of the transverse diameter of the inlet, one usually has reference to what actually constitutes its greatest transverse diameter. In contracted pelvises, however, this lies in such proximity to the sacrum that it becomes unavailable for the passage of the largest of those diameters of the fetal head which must pass transversely through the pelvic inlet. Under these circumstances, a transverse diameter located at a certain relatively fixed distance anterior to the sacral promontory is the truly significant one, and has been called the greatest available or obstetric transverse diameter. Few authors have defined its position and those who have believe it to be located midway between the symphysis and sacral promontory. We, however, believe that this is de-

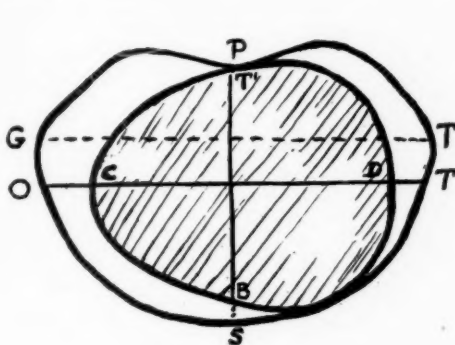


Fig. 1

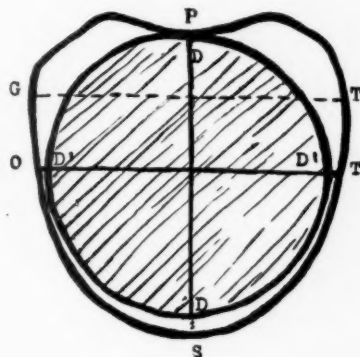


Fig. 2

Fig. 1.—*PS*, true conjugate. *BT'*, bitemporal diameter. *CD*, greatest cephalic diameter presented transversely. *GT*, greatest transverse diameter. *OT*, obstetric transverse diameter.

Fig. 2.—*PS*, true conjugate. *DD* and *D'D'*, equivalent to suboccipitobregmatic and biparietal diameters. *GT*, greatest transverse diameter. *OT*, obstetric transverse diameter.

termined by the most posterior position that could be assumed by the largest of those cephalic diameters which present transversely as the head enters the inlet. In simple flat pelvises this prevails when the head lies transversely in the inlet and in contact with the sacrum. In this position one parietal boss will occupy the concavity to one side of the sacral promontory and the bitemporal diameter, measuring 8 cm., will be presented for passage through the true conjugate. The longest transversely presenting cephalic diameter bisects the bitemporal diameter and will lie 4 cm. anterior to the promontory (Fig. 1).

In the case of a generally contracted pelvis, the head is in acute flexion and centrally placed when entering the inlet. In this attitude its presenting circumference is practically round, being determined by its suboccipitobregmatic and biparietal diameters, both of which measure 9.5 cm. An entirely similar cephalic diameter is presented for passage through the true conjugate regardless of the pelvic segment toward which the occiput is directed. Such a diameter is 9.5 cm. long when the

true conjugate measures 9.5 to 10 cm. but is equal to the latter diameter when, by a process of molding, it has been enabled to pass through a shorter true conjugate. In either circumstance, it is bisected by the longest transversely presenting cephalic diameter which latter will lie most posteriorly in relation to the inlet when the head is in contact with the sacral promontory. The point of bisection will then be 4.75 cm. anterior to this point when the true conjugate is 9.5 to 10 cm. long, and midway between the symphysis and promontory when the true conjugate measures less than 9.5 cm. (Fig. 2).

The obstetric transverse diameter is, therefore, for all practical purposes, located midway between the symphysis and promontory in gen-

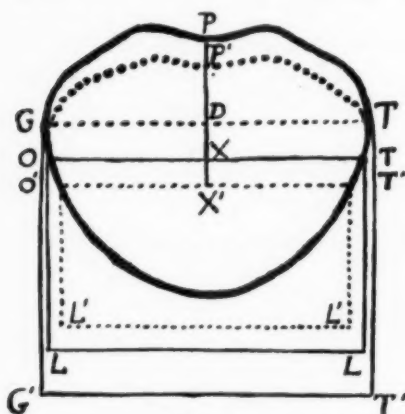


Fig. 3

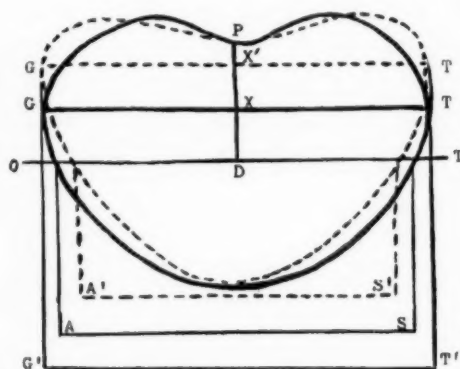


Fig. 4

Fig. 3.—To show effect of shortening of the true conjugate. *PP'*, promontory. *GT*, greatest transverse diameter. *PD* and *P'D*, distance of greatest transverse from promontory. *X* and *X'*, points at equal distances from *P* and *P'* respectively. *OT* and *O'T'*, obstetric transverse diameters at these points. *L'L'* and *LL*, length of *O'T'* and *OT*. *G'T'*, length of *GT*. As true conjugate becomes shorter, distance *PD* decreases and difference between *G'T'* and *LL* increases.

Fig. 4.—Showing effect of increased curvature of ileopectineal line in region of sacroiliac synchondrosis. *P*, promontory. *ODT*, transverse diameter at fixed distance from *P*. *PD*, distance of *ODT* from *P*. *GT*, greatest transverse diameters of the two pelvic inlets. *PX* and *PX'*, distances of *GT* from *P*. *AS* and *A'S'*, length of available transverse space at *ODT*. *G'T'*, length of greatest transverse diameter. As curvature increases, *AS* and *PX* decrease and difference between *G'T'* and *AS* increases.

erally contracted pelvis and 4 cm. anterior to the latter point in simple flat pelvis.

In our study of the pelvic inlet, we have employed the method of x-ray pelvimetry developed by Thoms. We find that the greatest transverse diameter tends to lie closer to the promontory and that the difference between its length and that of the obstetric transverse tends to increase as the true conjugate decreases. In other words, the lengths of the obstetric transverse diameters of pelvis whose greatest transverse diameters are essentially equal to one another will tend to decrease as the true conjugate becomes shorter (Fig. 3).

Variations in the contour of the pelvic inlet also have an important influence upon these diameters. When comparisons are made between

pelves whose greatest transverse and true conjugate diameters are respectively equal to one another, it is seen that the actual and relative length of the obstetric transverse is shorter the more acute the curvature in the region of the sacroiliac synchondrosis (Fig. 4).

While it is true that under similar conditions the greatest transverse diameter tends to lie closer to the sacral promontory, yet it is incorrect to attribute any differences in the obstetric capacities of such pelves to the slightly increased amount of encroachment of the sacral promontory upon this diameter. The underlying cause is to be found in differences in the lengths of the obstetric transverse diameters, these being dependent upon variations in the shape of the inlet of any two such pelves under consideration.

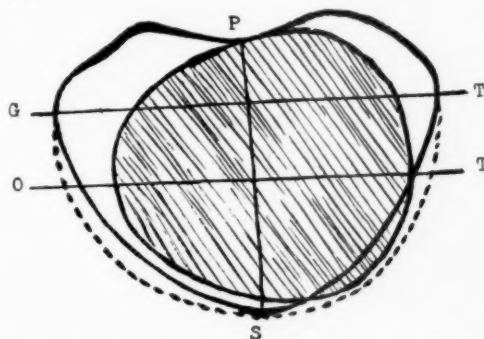


Fig. 5.—*PS*, true conjugate. *GT*, line of the greatest transverse diameter. *OT*, line of the obstetric transverse diameter.

Whereas a given true conjugate may be sufficiently long to permit the passage of an average sized fetal head when the obstetric transverse diameter is of one length, it may not be sufficiently long to permit of such an outcome with a somewhat shorter obstetric transverse, regardless of the length of the greatest transverse diameter (Fig. 5). This indicates that it is necessary to consider not only the actual length of the true conjugate and obstetric transverse diameters, but also their relationship to one another, in order to determine what we choose to call the obstetric capacity of any contracted pelvic inlet.

From the foregoing, it is evident that no reliable deductions of the length of any specifically located transverse diameter of the inlet can be drawn from the length of either the external measurements or from the greatest transverse diameter of the inlet itself. It would, therefore, seem proper to differentiate between simple flat and generally contracted pelves on the basis of the length of a transverse diameter located 4 cm. anterior to the promontory. This represents the location of the obstetric transverse diameter of a simple flat pelvis and by comparison with the location of the similar diameter of a generally contracted pelvis is, of the two, the nearer to the promontory. Accordingly, the diagnosis of a generally contracted pelvic inlet would appear warranted when, in pelves having a true conjugate of 10 cm. or less, the transverse diameter lo-

eated 4 cm. anterior to the promontory measures 11.5 cm. or less. The diagnosis of a simple flat pelvis would be warranted when, with a true conjugate of 9.5 cm. or less, the transverse diameter located 4 cm. anterior to the promontory measures more than 11.5 cm.

In Table I are tabulated the measurements of the accompanying illustrative case reports.

TABLE I

CASE		1	2	3	4
Interspin.		21.5	24.5	19	20.5
Intercrest.		24	29	23	24.5
Intertroch.		27.5	32	27	29
Ext. Conj.		16.5	19	15	17
Bituberous		10	10	10.5	9
Diag. Conj.		11	10.5	11.5	11.5
True Conj.		9.5	9	10	10
By X-Ray	T.C.*	8.8	8.8	9.5	10.5
	G.T.I.	13	12.5	12.25	12
	O.T.	12.5	10.5	11.25	11.75
	X	2.75	2.25	3.00	3.50

*T.C., true conjugate. G.T.I., greatest transverse of inlet. O.T., obstetric transverse. X, distance of greatest transverse from promontory.

CASE 1.—This is interesting in that the measurements obtained by ordinary methods of pelvimetry indicate a diagnosis of a generally contracted pelvis to be warranted. X-ray pelvimetry shows perfectly normal transverse inlet measurements, whereas the actual true conjugate is shorter than otherwise indicated. This pelvis should be classified as simple flat.

CASE 2.—The measurements usually taken indicate this pelvis to be of the simple flat variety. X-ray pelvimetry would seem to confirm this diagnosis if the greatest transverse diameter were a proper index of its width. There is, however, a sharper curvature in the region of the sacroiliac synchondrosis causing an increased degree of anterolateral flattening of the inlet, so that the obstetric transverse is 2 cm. shorter and the space available for the passage of the fetus obviously less than in Case 1. On this basis, this pelvis should be classified as of the generally contracted variety. From a practical standpoint, it is interesting to note that this patient had three previous difficult labors in each of which the fetus died as a direct result. She was seen for the first time after the onset of her present labor which terminated in the spontaneous delivery of a normal-sized living child presenting a deep groove over one parietal bossa and giving evidence of slight intracranial injury. With the size of the fetus estimated as being normal, pelvic measurements obtained by the usual methods certainly would have warranted a test of labor. However, x-ray pelvimetry postpartum, certainly explains the difficult labors and together with the history in-

dicates that elective cesarean section should have been performed. This is true in spite of the more or less favorable present outcome.

CASE 3.—The measurements obtained by ordinary pelvimetry indicate generally contracted pelvis of rather extreme degree. X-ray pelvimetry shows a true conjugate actually smaller than otherwise indicated and although the lateral contraction is not

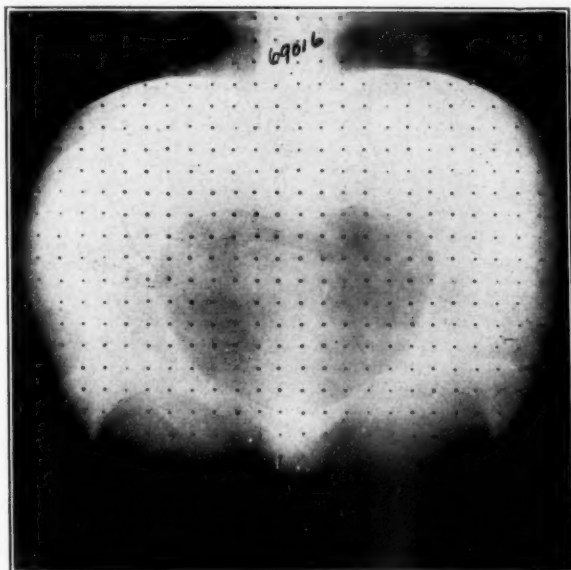


Fig. 6.—Case 1

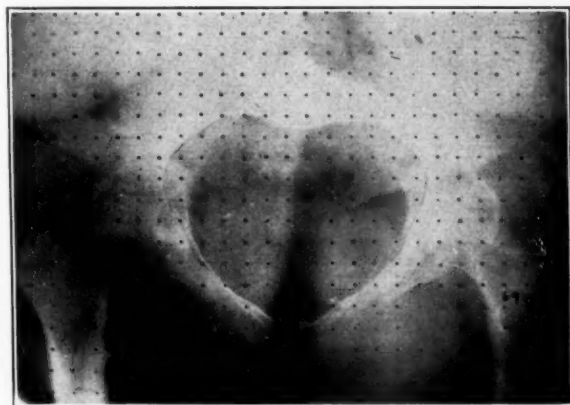


Fig. 7.—Case 2

as extreme as one may have been led to believe, the diagnosis of pelvic type is confirmed. A matter of far greater importance is that determination of the obstetric capacity of the inlet gives the attendant a greater degree of confidence in the probable result to be obtained by permitting the patient to have a test of labor. A normal child, weighing 3150 gm., was born spontaneously after a relatively easy labor.

CASE 4.—A seventeen-year-old primipara in whom ordinary measurements most definitely indicate a generally contracted pelvis of moderate degree. Because of the presence of a large fetus, the head of which was not deeply engaged at the onset

of labor, the possible desirability of performing cesarean section was considered by the physician in charge. However, determination of the obstetric capacity of the inlet by a study of the relationship between the length of the true conjugate and that of the obstetric transverse diameter, indicated that a trial of labor was justifiable, and that indeed these measurements were but slightly shorter than normal. Spontaneous delivery occurred after a short labor, the child weighing 4330 gm. and presenting the following measurements: biparietal 9 cm., bitemporal 8 cm., occipitometal 14.25, occipitofrontal 11.5 cm., suboccipitobregmatic 10.5 cm.

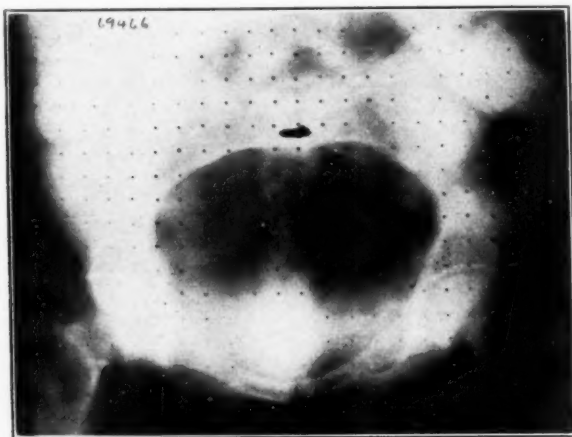


Fig. 8.—Case 3

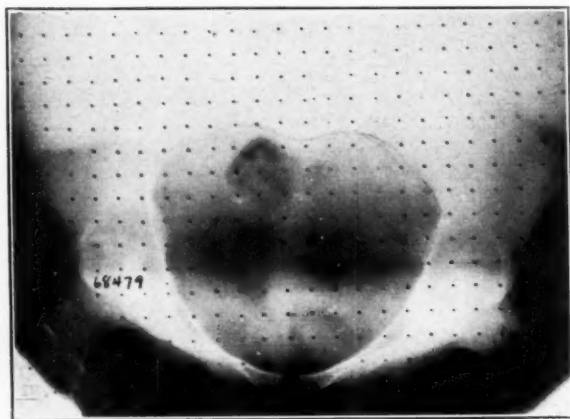


Fig. 9.—Case 4

We have mentioned the fact that when the true conjugate is shortened it is essential not only to measure the obstetric transverse but also to study the relationship of these two diameters to each other. This relationship, expressed in terms of the sum of these two diameters, determines the obstetric capacity of the inlet and may be called its "obstetric index." A definite statement as to the lower limit of a normal index value can only be made after a study of the outcome of labor in a very large series of contracted pelvises, and even then may have to be in-

terpreted with some elasticity. In such a study it will be necessary to note and distinguish carefully between the effects of those factors which influence the degree of dystocia and those that are primarily concerned with the degree of disproportion. This is important inasmuch as the outcome of labor in cases presenting equivalent degrees of disproportion will doubtlessly be found to vary because of differences in the hardness of the fetal head, the character of the uterine contractions, the physical status of the patient, and other factors. Correct interpretation will therefore depend upon a correct evaluation of the factors that influenced the result. From a purely theoretical standpoint, we believe that the lower normal index value is approximately 19.5 to 20 cm. This is based on the fact that the suboccipitobregmatic circumference with a diameter of 9.5 cm. is the smallest circumference which the head may present for passage through the pelvis. Thus, theoretically, the minimum requisite length of each, the true conjugate and obstetric transverse diameter, should be 9.5 cm. We know, however, that a given cephalic diameter can pass through a shorter pelvic diameter by reason of the process of molding, this being accompanied by a somewhat compensatory lengthening of the other cephalic diameters. Therefore, when one of the inlet diameters is less than 9.5 cm. there must, theoretically, be an increase in the minimum necessary length of the other diameter amounting to the extent of this decrease plus $\frac{1}{2}$ to 1 cm. allowance for space consumed by soft tissues. Case 2, which we presented, coincides with this theory.

CONCLUSIONS

Since the size of the pelvic inlet has a marked influence on the course of labor and usually plays the major role in determining the occurrence of disproportion, it is essential, for accurate diagnosis and for the proper management of labor, that our evaluation of its size be correct. In weighing the relative importance of all the factors that may influence the progress of labor when the true conjugate is shortened, we must appreciate the fact that in such cases disproportion may or may not be present, depending entirely upon the width of the pelvic inlet and that this factor alone may determine the outcome. Measurement of the obstetric transverse diameter, possible only by x-ray pelvimetry, should be done well in advance of the expected onset of labor in order that we may not be handicapped in selecting the best plan of treatment whenever the true conjugate measures 10 cm. or less.

In constituting a method for measuring the obstetric transverse diameter, x-ray pelvimetry should contribute to improved obstetric treatment and with it bring about a decrease in the number of cesarean sections done needlessly, as well as a decrease in the number of patients permitted to have an unavailing test of labor, because of insufficient or misleading data relative to the size of the pelvic inlet.

We wish to express our appreciation for the valuable technical assistance rendered us by Dr. Justin E. McCarthy.

ANAEROBIC STREPTOCOCCI IN THE VAGINA OF NORMAL CLINIC PATIENTS

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AS LONG as puerperal infection continues to be a problem of major significance in modern obstetrics, studies in the etiology of the disease are of fundamental importance. There are two primary sources of puerperal infection: the one, exogenous, introduced into the patient by the operator or attendant, and the other, endogenous, arising from organisms already present in the birth canal. The endogenous infections, particularly those of an anaerobic nature, are the basis of this discussion.

Krönig (1895) isolated and described an anaerobic streptococcus for the first time. Koblanck (1896) concluded that a species with such characteristics did not exist. Krönig and Menge (1897) published a monograph on the subject, and in 1899 they described two forms of anaerobic streptococci. Obligate anaerobiosis was characteristic of both types. Later, anaerobic organisms were described by various authors. Williams (1898) found, in three of 92 cases, cocci in pure culture in anaerobic media with sterile associated aerobic plates. Bumm and Sigwart (1904) described other species. Natvig (1905) felt that Krönig and Menge's findings were inconclusive. Herff (1905) mentioned anaerobic streptococci as etiologic factors in disease, but added that the "majority of anaerobic bacteria are in mixed cultures, and it is difficult to evaluate their rôle." Stargardt (1906) cultured anaerobic gas-forming streptococci from the lochia of well and sick women. Henkel (1908) stated that anaerobic streptococci were saprophytes, and Framme in the same year also classed them as saprophytes which could cause putrid intoxication. In the French literature Veillon and Zuber (1898) isolated an anaerobic organism identical with Krönig's coccus and described it as "*Micrococcus foetidus*." Hallé (1899) found this organism in the pus of Bartholinitis and in the uterus with placental retention as well as from the normal vagina. Cotlet (1899) found it in a periurethral abscess. Jeannin (1902) differentiated between *M. foetidus* and *S. anaerobius*. In 21 cases of putrid endometritis he isolated the former six times and the latter nine times. In 21 cases of retention of placenta the former was recovered six times and the latter three times. In five cases of putrid decomposition of the amniotic fluid the *M. foetidus* was found three times." Wegelius (1909) agrees with Natvig's later findings and isolated anaerobic streptococci in seven cases. Wegelius studied the organisms with relation to oxygen tension, optimum temperature, growth in anaerobic dextrose bouillon, anaerobic ascitic agar and milk. He determined pathogenicity by inoculation into mice and rabbits.

Although the anaerobic streptococci were recognized as entities there was much doubt as to whether or not such organisms were important factors in puerperal infection until Schottmüller (1910) reported a series of cases of puerperal sepsis, directly referable to anaerobic streptococci. In 1912, Rosowsky, working in Schottmüller's clinic apparently (?) with the same class of patients as those in whom

Schottmüller found anaerobic infections, examined the vaginal secretions of 100 patients. He found anaerobic streptococci in about 40 per cent of apparently normal women and concluded that "normally bacteria which live saprophytically are present in the vagina but under certain conditions, following either abortion or delivery, they can cause severe sickness."

Schottmüller's most important contribution regarding the rôle of anaerobic streptococci in puerperal infection received no definite recognition until Schwarz and Dieckmann, here, in 1925, confirmed the work and instituted routine anaerobic cultures on the obstetrical service of Barnes Hospital. Harris and Brown (1928) reported positive anaerobic growth for streptococci in 17 of 30 cases. Burt-White and Armstrong (1927) in 153 cultures of the cervix, record anaerobic streptococci in 35.9 per cent as against only 23.5 per cent of aerobic streptococci. Bryce (1928) in a series of 119 antepartum and 50 postpartum patients made all cultures aerobically and anaerobically. She notes a discrepancy between direct smear and culture findings, the former showing a predominance of large bacilli. This difference is probably due to selective media. Anaerobiosis favored the isolation of "vaginal bacilli." Occasionally an anaerobic streptococcus, *B. welchii* and unidentified bacilli were isolated. Wrigley (1930) considers *B. aerogenes capsulatus* as the most important of the anaerobic bacteria in the birth canal. In 31 cases with a putrid smelling discharge Wrigley found no *B. aerogenes capsulatus* but in most cases a coarse gram-positive staphylococcus, frequently a nonhemolytic streptococcus, *B. coli* and *Staphylococcus aureus* in their lochia.

Taylor and Wright (1930) in a thorough study of 1,123 cultures conclude in part that "obligate anaerobes were present in the vagina of one per cent of normal women. Later experiences with blood broth and long incubation suggest that these organisms are already commoner than our figures would suggest." Colebrook (1930) attributes two-thirds of the puerperal septicemic infections on his service to anaerobic streptococci. He has isolated nineteen strains of anaerobic streptococci from the blood, forming a heterogenous group. Some of these organisms conform to the *S. putridus* of Schottmüller and others do not. Colebrook concludes that these infections are missed because of failure to recognize the anaerobic features. Bigger and Fitzgibbon (1925), Cruickshank and Baird (1930), Mays and Ullian (1930), Dafoe (1930) in studies of the vaginal flora make no mention of anaerobic cultures being performed. Recently Brown summarized the anaerobic infections here from 1925 to 1930.

In an unpublished series of cases one of us (Brown) prepared a series of anaerobic cultures from several apparently normal pregnant women. These cultures were taken, respectively, from the anus, fourchette, labia, hymenal ring, lateral wall of the vagina, the posterior lip of the cervix and from the cervical canal. In each set of cultures the same phenomena were observed. Cultures from the anus revealed heaviest anaerobic growth with characteristic odor, morphology, typical pigment formation, and protein digestion. As one progressed up the birth canal the same organisms were isolated but with a progressively decreasing variety and growth of organisms until at the cervix negative cultures were obtained. From the cervical canal, frequently, no growth was demonstrated.

Considering the important rôle that anaerobic organisms play in puerperal infection, varying from the fatal sepsis to localized acute endometritis in the parturient; and also that many foul-smelling vaginal

discharges have their origin in anaerobic infections, it is important to determine, first, the frequency of anaerobic organisms in the vagina of the pregnant woman; second, the detailed bacteriology of the organism as well as their pathogenesis to experimental animals; and third, their elimination from the parturient canal as a source of infection. The present paper deals with the frequency of anaerobic organisms in 207 vaginal cultures taken from 103 white and colored patients of the obstetric clinic of the Washington University Out-Patient Department.

TECHNIC

The patients were unselected and no instructions were given as to personal hygiene prior to presentation in the clinic. With the patient in the lithotomy position, the labia were separated widely and a sterile Graves speculum was inserted. In practically all cases, when the speculum was opened, the cervix could be seen to come into the field. As the posterior lip of the cervix came into view, a culture was taken therefrom with a tightly rolled sterile swab. This portion of the cervix lies in approximation with the vaginal mucous membrane in the posterior fornix and is farthest away from the introitus and is the most favorable site of the vaginal tract for anaerobic growth. This swab was streaked on two blood agar slants, one for the aerobic and one for the anaerobic culture, then dipped into a meat tube, and finally a direct smear was made on a glass slide. The direct smear was examined as soon as prepared. The aerobic slant was examined in twenty-four to forty-eight hours and smears made therefrom. The meat tube and anaerobic tube were allowed to go as long as necessary to obtain optimum growth. At the onset of this work anaerobic cultures were terminated in five days. Later we allowed the cultures to go seven to ten days and very frequently developed much better colonies, especially for the black pigment-producing organisms which stained faintly gram-negative. The duration of the anaerobic cultures depended, therefore, entirely on the appearance of the culture tube. All smears were stained with Gram's stain.

The aerobic slants and plates were prepared with 10 per cent human blood serum and 2.5 per cent R.B.C. obtained from citrated blood. Anaerobic media consisted of the same slants prepared, after inoculation, by Wright's pyrogallie acid-sodium hydroxide method. The meat medium is an unfiltered hormone beef medium prepared originally by Dr. Howard Bell.

RESULTS

As has been noted by several observers, there is a discrepancy between direct vaginal smears and culture findings. In our series practically all direct smears revealed, in addition to other organisms, gram-positive bacilli, long or short and frequently in chains. In 26 of the 207 cases, this positive smear of bacilli was the only evidence of the presence of bacteria, the corresponding cultures proving entirely negative or with extremely scant growth. No attempt was made to select a medium particularly adapted for this organism. It (or they) undoubtedly fall into the group of "Vaginal Bacilli." Positive aerobic growth, without associated anaerobic growth, occurred in 26.6 per cent of the cultures and in approximately the same degree of fre-

TABLE I. FREQUENCY OF ANAEROBIC ORGANISMS IN NORMAL PREGNANT WOMEN

TYPE OF PATIENT	NO. OF PA- TIENTS	NO. OF CULTURES	POS. AEROB. WITH NEG. ANAEROB.	PER CENT	POS. ANAEROB. WITH NEG. AEROB.	PER CENT	POS. ANAEROB. GROWTH	PER CENT	POS. ANAEROB. STREP.	PER CENT
White Primip.	20	37	8	21.7	2	5.4	26	70.0	17	46.0
Negro Primip.	25	59	16	27.1	6	10.1	37	62.7	28	47.4
White Multip.	28	49	13	26.8	5	10.2	24	49.0	14	28.5
Negro Multip.	30	62	18	29.0	7	11.3	37	60.0	22	35.5
Total	103	207	55	26.6	20	9.5	124	60.5	81	39.5

quency in white and negro patients as well as in primiparae and multiparae.

The usual aerobic organisms were recovered: *Staphylococcus albus*, diphtheroids, colon bacilli, one streptothrix, two yeasts, and a few non-hemolytic streptococci. Hemolytic streptococci were never isolated in this series of cultures.

Anaerobic growth alone without related aerobic development was found much more infrequently, in only 9.5 per cent of the cultures. However, anaerobic growth either associated with aerobiosis or alone was present in 60 per cent of all cases, 59 per cent in white and 61 per cent in negro women, and definitely more frequently in the primiparae

TABLE II. ANAEROBIOSIS IN WHITE AND NEGRO PATIENTS

TYPE OF PATIENT	NO. OF PATIENTS	NO. OF CULTURES	POSITIVE ANAEROB. GROWTH	PER CENT	POSITIVE ANAEROB. STREP.	PER CENT
White Primip.	20	37	26	70.0	17	46.0
White Multip.	28	49	24	49.0	14	28.5
Total	48	86	50	59.5	31	36.0
Negro Primip.	25	59	37	62.7	28	47.4
Negro Multip.	30	62	37	60.0	22	35.5
Total	55	121	74	61.3	50	41.5

TABLE III. ANAEROBIOSIS IN PRIMIPARAE AND MULTIPARAE

TYPE OF PATIENT	NUMBER OF PATIENTS	NUMBER OF CULTURES	POSITIVE ANAEROBIC GROWTH	PER CENT	POSITIVE ANAEROBIC STREP.	PER CENT
White Primip.	20	37	26	70.0	17	46.0
Negro Primip.	25	59	37	62.7	28	47.4
Total Primip.	45	96	63	66.3	45	46.7
White Multip.	28	49	24	49.0	14	28.5
Negro Multip.	30	62	37	60.0	22	35.5
Total Multip.	58	111	61	54.5	36	32.0

of both classes of patients. Elimination of the anaerobic growth which was facultative or obligate for organisms other than anaerobic streptococci reduces the frequency of anaerobic streptococci to 39.5 per cent of all cultures. These figures are in harmony with the statistics of Rosowsky (1912), in Schottmüller's clinic, and of Burt-White and Armstrong.

SUMMARY

1. Aerobic hemolytic streptococci were not isolated in any of 207 cultures from the vagina of normal pregnant women.
2. Anaerobic growth was noted in 60 per cent of all patients and in approximately the same frequency in white and negro clinic patients.
3. Anaerobic streptococci were isolated in about 40 per cent of all cases and slightly more frequently in negro than in white patients.
4. Anaerobic streptococci were noted definitely more frequently in primiparae than in multiparae.

CONCLUSIONS

Schwarz and Dieckmann, and Brown, of this hospital, have definitely proved that anaerobic streptococci can and do give rise to all grades of puerperal sepsis. The isolation of these organisms from the vagina of 40 per cent of normal pregnant women confirms the conclusions of Rosowsky that "these bacteria live saprophytically in the vagina, but under certain conditions following abortion or delivery they can cause severe sickness."

Analysis of our morbidity statistics has shown a very definite improvement following prophylactic use of vaginal instillations of M.G.I. (mercurochrome-iodine-glycerin) during labor. It is probable that the glycerin portion of the mixture is the most effective, due to its antiseptic properties. In an attempt to improve the mixture a one per cent solution of neutral acriflavine in glycerin has been adopted recently and results since January 1, 1931, indicate even better effects than with the mercurochrome-iodine-glycerin combination. The severe postpartum puerperal infections, which we have studied, have been due chiefly to cocci of various types. Since acriflavine has a predilection for cocci, we hope to make a direct attack upon the organisms involved by the use of acriflavine in glycerin.

From our experiences we consider puerperal infections, due to anaerobic streptococci, as frequent and often serious. We regard these infections chiefly as endogenous in origin. They are, therefore, of greatest importance to the trained obstetrician, in whose practice hemolytic streptococcal infections are seldom seen. In the present state of our knowledge of these organisms, antiseptic treatment of the vagina seems the most logical means of combating them. We hope to prove this point more definitely by continuing the use of the above mentioned antiseptic vaginal instillations.

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REPORT OF 535 CONSECUTIVE CASES OF MID AND HIGH FORCEPS*

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DURING the four years from January 1, 1926, to January 1, 1930, there were delivered at the Methodist Episcopal Hospital in Brooklyn 7,807 obstetric cases. Of these, 535 cases were delivered by either mid or high forceps. This number includes both ward and private service deliveries.

It is my purpose to show the incidence of trauma in the use of mid and high forceps operations and incidentally to show the difference in amount of that trauma on the ward and private services. In making any comparison between the two services certain factors must be kept in mind. First, let me define the terms mid and high forceps as used in this report. Williams' classification of these operations was used and I repeat that here for clarity. The operation was classed as a mid forceps when the presenting part rests "at or just above the ischial spines" and as a high forceps when "the head has partially descended into the pelvic canal but its greatest circumference has not passed the superior strait." In no instance in this report were forceps applied to the floating head. The private patients are practically all delivered by men who specialize in obstetrics, while the ward patients are for the most part delivered by the interns and for the past two years by the resident. There is, of course, supervision of the interns and resident but the actual delivery is usually accomplished by them. The ward service receives a slightly higher proportion of emergency cases. And lastly, the cesarean section ratio on the private service is higher than that on the ward.

The high forceps, of which there were 56 cases on both services, had an incidence of 0.72 per cent and the mid forceps, of which there were 479 cases, 6.25 per cent. On the ward service where 3,332 patients were delivered during the period covered by this paper, there were 16 high forceps operations with an incidence of 0.49 per cent and 94 mid forceps operations with an incidence of 2.8 per cent. On the private service, where there was a total of 4,475 patients delivered, 40 of the women were delivered with high forceps, making an incidence of 0.88 per cent, and 385 were delivered with mid forceps, an incidence of 8.3 per cent. The forceps incidence, it will be seen, was considerably higher on the private service than on the ward.

*Read before the Brooklyn Gynecological Society, May 1, 1931.

There were in this series of mid and high forceps operations but two maternal deaths, a maternal mortality rate of 0.39 per cent. One of these deaths was on the ward and one on the private service and both occurred after mid forceps delivery. The death on the private service was that of a woman with a neglected toxemia, probably nephritic, at seven months. She was delivered of a stillborn child after bag induction and seemed to improve after delivery. Within a few days, however, she developed a true encephalitis and died at the end of two weeks. The ward mother who died was a clinic patient. She was admitted in advanced labor, having extremely severe pains, and was delivered very shortly after admission. The indication for delivery had been a marked fetal distress and a stillborn child resulted. The mother bled profusely after delivery and, despite prompt treatment, died of postpartum hemorrhage within half an hour.

There was a total of 57 mothers in this series who had a temperature of 100.4° or higher for two or more consecutive days after the first day postpartum. The morbidity rate in this series was therefore 10.6 per cent. It will be noted that the ward service showed a lower morbidity percentage than the private service. The rate after high was, as would be expected, higher than after mid forceps delivery.

In the complete series there were 38 babies lost either at delivery or during the stay at the hospital, giving a total fetal mortality rate of 7.1 per cent. Twenty-two of these, or 4.1 per cent of the number delivered in the series, were stillbirths, 16 or 2.9 per cent were neonatal deaths. The ward patients suffered 16 fetal catastrophes for a total fetal mortality rate of 14.5 per cent. Thirteen of these were stillbirths and three neonatal deaths, percentages of 11.8 per cent and 2.7 per cent respectively of the number of cases delivered on the ward. On the private service there were 22 fetal deaths or a total mortality of but 5.1 per cent and of these, 9 were stillbirths, a rate of 2.1 per cent, and 13 were neonatal deaths, a rate of 3.05 per cent. The figures for the ward are therefore seen to be almost three times as high as those for the private service.

Fifty-six high forceps operations were done with 6 stillbirths and 6 neonatal deaths giving a total fetal mortality of 12 or 21.4 per cent of the high forceps cases. Sixteen of these operations were reported from the ward service with 4 stillbirths and 2 neonatal deaths, a total fetal mortality rate of 37.5 per cent, stillbirth rate of 25.0 per cent and neonatal death rate of 12.5 per cent. On the private service there were 6 fetal fatalities in the high forceps group giving a fetal mortality rate of 15.0 per cent. Two of these were stillbirths and 4 neonatal deaths or percentages of 5 per cent and 10 per cent respectively.

There were 26 fetal fatalities in the 479 mid forceps operations of this series, a mortality rate of 5.4 per cent. Sixteen of these fatalities

were stillbirths and 10 were neonatal deaths, respective percentages of 3.3 per cent and 2.1 per cent. Ninety-four patients were delivered on the ward service with 10 fetal catastrophes, a rate of 10.6 per cent, 9 of these being stillbirths and one a neonatal death, respective percentages of 9.4 per cent and 1.06 per cent. On the private service 385 patients were delivered by mid forceps with 16 babies lost, a percentage of 4.1 per cent, and of these, 7 were stillbirths and 9 neonatal deaths or percentages of 1.8 per cent and 2.6 per cent respectively.

These figures are for all the babies that were lost regardless of the cause. I shall now endeavor to show the causes of these various fetal catastrophes and the fetal mortality due to delivery. Let us first consider the ward stillbirths, 13 in number, 4 due to high and 9 to mid forceps delivery. In the high forceps group 3 babies died during delivery and one during labor but before delivery. This latter was a craniotomy done on a dead fetus because of severe toxemia of the mother. The causes of the other three deaths were given as cerebral hemorrhage, fetal asphyxia, and loop of cord around shoulder. Autopsy was done on the first of these and confirmed the diagnosis but no autopsy was done on the other two. The last case must be classified as a death due to delivery for there was here the possibility of birth injury, a sixty-four-hour labor with delivery by axis-traction forceps through a funnel pelvis.

Of the 9 stillbirths in the mid forceps operations on the ward, 7 died of cerebral hemorrhage and autopsies confirmed the diagnoses. One of these fetuses, however, died during labor and before delivery, the diagnosis of dead fetus having been made before beginning the delivery. Of the two remaining stillbirths, one died of unknown cause and the other of intrauterine asphyxia, and both these deaths occurred during delivery. There was in neither case an autopsy.

There were but 3 neonatal deaths on the ward service, two following high and one following mid forceps delivery. Of those following high forceps the causes of death were cerebellar hemorrhage and ruptured liver. Both these diagnoses were confirmed at autopsy and the deaths must be considered as due to delivery. The one neonatal death after mid forceps was proved at autopsy to be due to patent ductus arteriosus.

On the private service there were 9 stillbirths, 2 due to high and 7 to mid forceps. Both those due to high forceps were attributed to intrauterine asphyxia and both the deaths occurred during delivery. In only one was the diagnosis confirmed by autopsy.

In the mid forceps group 2 of the 7 deaths occurred before admission to the hospital, and the causes of death were cord tightly about neck and gangrenous, and trauma due to attempted delivery at home by a midwife. In two others death occurred before labor began, one being

a macerated fetus upon which craniotomy was done, and the other a premature, the mother of which had a very severe neglected toxemia. One death was due to anencephalus. Only two of these stillbirths presented evidence of birth injury. Both died during delivery and the diagnosis in each case was considered to be intracranial hemorrhage. No autopsies were performed in this group.

The private service had 13 neonatal deaths, 4 following high and 9 following mid forceps delivery. Three of the 4 deaths after high forceps were considered to be due to intracranial hemorrhage although confirmation by autopsy was lacking in all three. The fourth death, fifteen days after birth, was due to congenital heart disease and bronchopneumonia as proved by autopsy.

Of the neonatal deaths after mid forceps on the private service, there was one from gastroenteritis on the fourteenth day after birth, another from bronchopneumonia on the sixteenth, and another from icterus neonatorum gravis on the second day. The two latter diagnoses were confirmed at autopsy. One baby died on the second day after birth of what was considered to be hemorrhagic disease of the newborn. There was no autopsy here but the diagnosis was made by the pediatrician and there was no suggestion of birth injury. The mother had had two previous children normally and this was a six and one-half pound baby delivered without undue difficulty after a six-hour labor. The remaining five babies died of what was considered clinically to be intracranial hemorrhage, although autopsy was not performed in any case for confirmation. It is interesting in this connection to note that of the 23 private cases considered here but 4 had autopsies while of the 15 ward cases 11 had autopsies. This is accounted for probably by the reluctance of the attending obstetrician to ask a private patient for autopsy.

A summation of our inquiry into the causes of death of these babies reveals the fact that 25, or 4.67 per cent of the total number delivered by mid and high forceps, died of causes that may be attributed to the delivery. The ward service presents a mortality of 13 cases or 11.8 per cent of the 110 delivered by mid and high forceps, with 11 of these 13 being stillbirths and 2 neonatal deaths. The private service had but 12 such fetal fatalities out of 425 deliveries, a mortality rate of 2.8 per cent. Four of these fatalities were stillbirths and 8 were neonatal deaths.

There were 10 babies lost as a result of delivery by high forceps, a total mortality rate of 17.8 per cent, 5 of these were stillbirths and 5 were neonatal deaths. The ward service had 3 stillbirths and 2 neonatal deaths, a total of 5 deaths or 31.2 per cent of those delivered by this operation. The private service had 2 stillbirths and 3 neonatal deaths, also a total of 5 fatalities but here the percentage was only 12.5 per cent.

Fifteen babies were lost as a result of mid forceps delivery, a total mortality rate of 3.1 per cent, 10 of these were stillbirths and 5 were neonatal deaths. On the ward service there were 8 deaths, all stillbirths, with a mortality rate of 8.5 per cent. Figures from the private service show a total of 7 deaths, 2 stillbirths and 5 neonatal deaths, a total mortality of but 1.8 per cent.

Two facts are outstanding in a comparison of the ward and private service figures for fetal deaths due to delivery. The first is the higher mortality of the ward service and the second that 84 per cent of the ward mortality is attributable to stillbirths while only 33.3 per cent of the private service mortality may be attributed to stillbirths. Many factors undoubtedly play a part in the explanation of these facts. Included in these are the difference in ability of the men delivering the cases, the care taken of the woman by herself during pregnancy, the resistance of the child, the type of pelvis, the position of the child's head, and the length of labor. A discussion of any but the latter three factors would carry us beyond the scope of this paper. However, a discussion of these three may help to determine the causes of this discrepancy. In the whole series there were 184 contracted pelves, 103 of these being of the funnel type, 29 of the flat, 26 of the generally contracted, and the few remaining divided among the other types. A few pelves were classed as contracted but no type was given. Twenty-five babies died as a result of delivery and 19 of the babies so lost were delivered through contracted pelves, 12 through funnel, 4 through flat, 2 through generally contracted funnel, and one each through generally contracted and generally contracted rachitic pelves.

The incidence of contracted pelves on the ward service for the entire series was 43.6 per cent, 110 cases being considered with 48 complicated by contracted pelves. On the private service 132 contracted pelves occurred in 425 cases, a percentage of 31.0 per cent. But a consideration of the cases where fetal death was due to delivery shows an almost equal percentage of abnormal pelves on the two services. On the ward service 13 babies died as a result of delivery, two being neonatal deaths, 11 stillbirths. Ten of these were delivered through contracted pelves, 6 through funnel, 2 through flat, and one each through generally contracted funnel and generally contracted rachitic pelves. The remaining 3 were delivered through normal pelves. There were 76.9 per cent of the fetal catastrophes, therefore, which occurred in cases of contracted pelves. On the private service 12 babies were lost from delivery, 8 being neonatal deaths and 4 stillbirths. Here 9 were delivered through contracted pelves, 5 through funnel, 2 through flat, and one each through generally contracted and generally contracted funnel pelves. Two of the remaining 3 were delivered through normal pelves and the other through a pelvis, the

measurements of which were not given. There were 75.0 per cent of the fetal catastrophes of the private service, therefore, which occurred in cases of contracted pelves. No great difference is apparent in the incidence of contracted pelves in the two groups where fetal death was due to delivery, and the incidence of funnel pelvis, which in this series was the most common contraction, is approximately the same.

The occipitoposterior position was a frequent complication in this series of cases, 286 of the 535 showing the fetus in either right or left occipitoposterior position. Of the 25 fetal deaths due to delivery, 15 of the babies were delivered from an occipitoposterior position. On the ward service there were 50 occipitoposterior positions in the 110 cases, a percentage of 45.5 per cent, and on the private service 236 in the total of 425 cases, a percentage of 55.5 per cent. On the ward service, of the 13 babies lost from delivery, 8 were delivered from an occipitoposterior position, while on the private service where there were 12 fetal deaths from delivery, 7 were delivered from that position. The percentages in these 2 instances are 61.5 per cent and 58.3 per cent respectively. Here again the percentage of abnormality is about the same on the two services in those cases where fetal death was due to delivery.

The average length of labor in the ward cases where death of the baby was due to delivery was 36.09 hours, with the second stage averaging 1.42 hours. On the private service in these cases the average duration of labor was 26.2 hours and the average second stage 1.7 hours. The averages on the private service do not include one case in which no note of length of labor was made. There is seen, therefore, to be a very definitely shorter average labor on the private service with a slightly longer second stage.

The parity of the mothers in the cases where fetal death was due to delivery is interesting. In 15 out of the 25 cases the babies lost were those of primiparous women and 7 of these were on the ward and 8 on the private service. The remaining 10 were multiparae and 6 of these were parae four or more. Three of the 4 fatal cases delivered through flat pelves were multiparae and all the babies lost through flat pelves were lost as stillbirths. The ratio of primiparae was about the same on both services, 7 out of 13 on the ward and 8 out of 16 on the private service.

In attempting to discover the causes of the discrepancy between a fetal mortality due to delivery of 11.8 per cent on the ward and 2.8 per cent on the private service, we find that in those cases where the babies were lost through delivery the incidence of both contracted pelvis and occipitoposterior position are practically the same on the two services. The length of labor was, however, ten hours longer on

the average in the ward cases although the average second stage was slightly longer on the private service. Undoubtedly the greater length of labor on the ward service accounts for some of the discrepancy in the figures. This would be particularly true if the baby for some reason were less resistant to trauma. It may also be said that since the figures for the ward service are based on a smaller number of cases a certain amount of the discrepancy might be accounted for by this fact alone. The ward service furnished only 110 cases, it is true, while the private service furnished 425, yet the mortality due to delivery was actually greater on the ward, 13 deaths against 12. The number of emergency cases on the ward is not sufficient to explain the difference in mortality for the vast majority of cases are followed in the clinic, not more than one or two per cent being admitted without previous care. Even making a fair allowance for any other factors, it seems to me that the two chief factors in the discrepancy are the greater length of labor on the ward and the fact that the private patients are delivered by trained obstetricians. I do not mean these figures and conclusions to be an indictment of the practice of allowing men in their training to do these more difficult operations but rather to be a plea for proper training of men to carry on the practice of obstetrics in difficult cases. Nor do I believe that our figures are higher than those of any other hospital where an honest effort is made to equip men to do obstetrics properly.

It was very difficult to discover any figures published within the last five years that might serve as a comparison with ours. In 1926 von Thurm Rumbach reported from the University of Budapest a series of cases for ten years. In this there were 78 high forceps with a fetal mortality of 17.8 per cent and 444 mid forceps with a fetal mortality of 7.0 per cent. These figures are comparable to our fetal mortality rates due to delivery for the two services combined and show a marked similarity to our figures for high forceps but some increase over ours for mid forceps. The maternal mortality in that report was 1.26 per cent but included the low as well as the mid and high forceps operations.

Duncan of Montreal presented a series of forceps cases done on healthy women. In this report the hospital cases, comparable to our ward series except that the cases were chiefly anterior positions, showed a fetal mortality of 40.0 per cent in high forceps and 4.9 per cent in mid forceps. Of his private cases the mortality in high forceps was 18.1 per cent and mid forceps 6.0 per cent. His figures in all these classes of cases were higher than ours except for his hospital group of mid forceps. He had no maternal mortality whatever in his series but it must be remembered that his group included only healthy women while ours was a summary of all the deliveries for the four years.

CONCLUSIONS

1. The forceps incidence is greater on the private service than on the ward. For high forceps the incidence on the private service is 0.88 per cent and on the ward 0.49 per cent, for mid forceps on the private service 8.3 per cent and on the ward 2.8 per cent.
2. Mid and high forceps operations entail less danger to the mother than cesarean section. Mortality rate in these forceps cases was 0.39 per cent against a mortality rate of 3.88 per cent in our last 500 cesarean sections.
3. The fetal mortality due to delivery by mid and high forceps operations is 11.8 per cent on the ward and 2.8 per cent on private service.
4. Delivery by high forceps gives a high fetal mortality due to delivery, 17.8 per cent, and the figures for the ward service are over twice as high as those for the private, 31.2 per cent as against 12.5 per cent.
5. Mid forceps delivery causes a fetal mortality of 3.1 per cent, about one-fifth of that caused by high forceps delivery. The figures for the ward service in mid forceps delivery, 8.5 per cent, approach the figures for high forceps delivery on the private service, 12.5 per cent. Private service has but 1.8 per cent fetal mortality due to mid forceps delivery.
6. Nineteen per cent of the cases presented here were delivered through funnel pelves.
7. Fifteen of the 25 babies lost from delivery were delivered from an occipitoposterior position.
8. In the cases where fetal death was due to delivery, the percentage of contracted pelves and occipitoposterior positions was the same on both services.
9. Where fetal death was due to delivery the average length of labor on the ward was 36.09 hours and on private service 26.2 hours.
10. An analysis of the factors involved in the discrepancy between the figures for fetal mortality due to delivery on the ward and private services (11.8 per cent and 2.8 per cent respectively) indicate that the difference in ability between the trained obstetrician and the man in training is a very important factor.
11. The figures given in this report compare favorably with other available figures for similar clinics.

THE IMPORTANCE OF THE POSTURE OF THE CARDIOPATH DURING PREGNANCY AND LABOR*

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THE seriousness of organic heart disease complicating pregnancy and labor is emphasized by the increase in the literature on this subject in recent years. The rather recent addition of a cardiologist to every well-organized maternity service further demonstrates that the cardiopath is an important problem in obstetrics. The problem that the cardiopath presents during pregnancy and labor is how to relieve the crippled heart of every possible strain. On the basis of clinical experience and a study of the cardiorespiratory physiology, I am convinced that attention must be given to the posture of the cardiopath during pregnancy and labor, and that the avoidance of a supine posture is an important prophylactic measure in that it relieves the crippled heart from an extra strain.

A review of the obstetric literature demonstrates that notwithstanding our increased knowledge of cardiology, the management of the cardiopath is as much a problem today, as it was when Angus MacDonald¹ wrote his excellent paper, "On the Bearing of Chronic Diseases of the Heart Upon Pregnancy and Parturition" in 1877. Fritsch² in 1876 wrote that the respiration alone regulates the heart's action by its aspiratory power. He maintained that while the respiration regulates and controls the circulation, the heart force maintains it, and a failure of the aspiratory power causes a defective supply of blood to the heart, and it must accumulate in the abdomen. Pardee³ has given the cardiopath much thought, and in spite of his success with his "test exercise," sums up his observations relative to prognosis as follows: "The problem is fundamentally difficult, for we are called on before pregnancy or during the early months to say what will be the reaction of a heart, some months later, to a strain whose severity we cannot truly predict." Reid⁴ sums up the prognosis as follows: "Prognosis is affected by the case given and the skill used in the treatment of the individual case." He believes that the classification of the cardiopath is so variable that the prevailing statistics are of little value. Hamilton and Kellogg⁵ as a result of their experience have stated, "There are practically no warning signs to enable one to prophesy an impending cardiac failure." Paddock⁶ stated that no one is able to prognosticate a cardiopath, and insisted that a cardiologist share the responsibility. Nelius⁷ from his experience, also concluded that it is almost impossible to foretell the outcome of a cardiopath, since the course may be favorable with a serious valvular defect, and may be grave with an insignificant heart lesion. Newell⁸ recognizes the seriousness of the management of the cardiopath by stating, "Labor should be made as short and easy as possible, even though no symptoms are present." Reid⁹ expressed the opinion that interference with the respiratory function is more important than the effect of return of blood to the right side of the heart. Hamilton and Kellogg¹⁰ realize the importance of the "purely mechanical burden of the uncomplicated pregnancy," and have had decompensation occur in some patients from this factor. Williams¹¹ has reported that collapse may occur immediately after delivery of the child, due to a marked drop in arterial pressure, and points out that every woman in the last weeks of pregnancy suffers more or

*Read at a meeting of the Chicago Gynecological Society, May 15, 1931.

less from shortness of breath resulting from interference with the motility of the diaphragm by the enlarged uterus. DeLee¹² has written that the high position of the diaphragm in pregnancy augments the respiratory difficulty and cyanosis.

Sir James Mackenzie¹³ in discussing the cardiopath in pregnancy makes a very significant statement in regard to posture and one with which the author is in complete accord. He points out that it is necessary to understand the physiology of the cardiorespiratory system, and to be able to recognize the early manifestations of cardiac failure, and institute prompt treatment. His opinion on the prognosis of the cardiopath is based upon the response of the heart to certain tests. When the slightest evidence of cardiac failure occurs, he recommends that, "She should be encouraged to sit up or to be propped up in bed, since lying down, by restraining the movements of the ribs, tends to hamper the circulation of the bases of the lungs."

The importance of avoiding the supine posture was brought to the author's attention by one case in 1922. The prophylactic value of this measure was confirmed in another case in 1930, which stimulated this inquiry into the value of the semirecumbent posture as a prophylactic aid. Two cases will be briefly given.

CASE 1.—Mrs. P. T., twenty-four years of age. Primipara. History of no importance, except of an attack of tonsillitis in 1919, and followed by a mitral lesion. Expected labor December 25, 1921. Patient would not heed prenatal instructions, and was extremely active. On December 15, she developed cardiac failure. She was treated by the usual methods, and since labor was overdue, and the patient in good condition, induction was advised. On January 9, 1922, the patient entered the Mount Sinai Hospital. Diagnosis: L.O.A., head low in the excavation, postmature, complicated by mitral stenosis. At 6:30 P.M., the patient was placed in the lithotomy position, and without an anesthetic (on account of the previous cardiac asthma), the cervix was stretched with a Goodell dilator, the lower uterine segment, cervix and the vagina were packed with plain gauze. At the end of the operation the patient suddenly became markedly cyanotic and dyspneic, expectoration of a frothy blood-tinged sputum, skin cold and clammy. Temperature 98.8°, pulse 80, weak and irregular, and respirations 40. Diagnosis: pulmonary edema due to cardiac failure. The packing was removed, and the patient was treated for the cardiac condition. Patient improved, and labor set in on January 13. On January 15, at 5:15 A.M., temperature 98.8°, pulse 82, and respirations 32; effacement and dilatation complete and the head low in the pelvic excavation. Low forceps, left episiotomy and an easy extraction accomplished under light gas oxygen anesthesia in the lithotomy position. Placenta delivered at 5:50 A.M., by expression. A living child weighing 2435 grams was delivered which died on the sixth day from bronchopneumonia. The puerperium was uneventful, temperature ranging from 97.4° to 99.4°, pulse from 50 to 82, and the respirations from 20 to 28. The patient was discharged from the hospital on the sixteenth day postpartum.

The patient was seen on September 13, 1922 and was found to be pregnant about eight weeks. Expected labor April 30, 1923. During this pregnancy the patient followed prenatal instructions carefully. During the pregnancy the patient's condition was good with occasional mild attacks of dizziness and dyspnea, pulse between 80 and 92, blood pressure 78 to 90 systolic, and 45 to 65 diastolic, until April 18. She began to complain of dizziness and dyspnea and spots before the eyes on slight exertion which was relieved by rest in bed. Pulse 80 and of fair quality, blood pressure 87/45, breath sounds clear over the bases of the lungs. Diagnosis: L.O.A., pregnancy about thirty-eight weeks, complicated by mitral stenosis and an oncoming cardiac failure, induction of labor was decided upon. The patient was digitalized,

and on April 24 she was placed in a semirecumbent position, and a bag was introduced into the uterus. On April 26, the bag was removed on account of no uterine contractions. Uterine contractions set in on April 28, and on April 30, at 3:15 A.M. effacement and dilatation were complete, with the patient in a semirecumbent position of about 45 degrees; under a light ether anesthesia, low forceps, and a left-

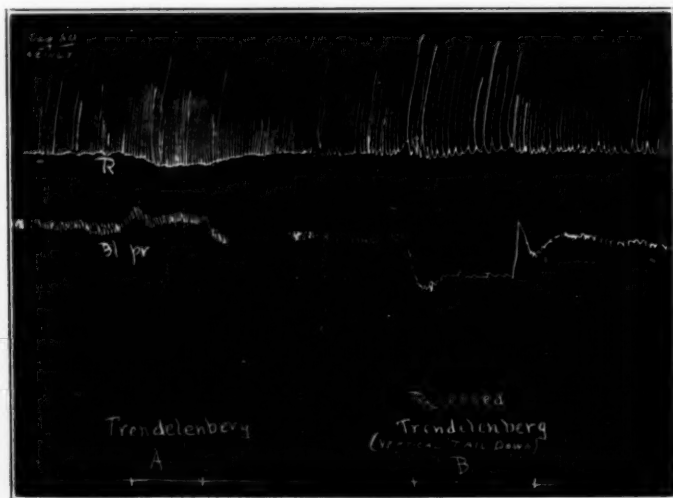


Fig. 1

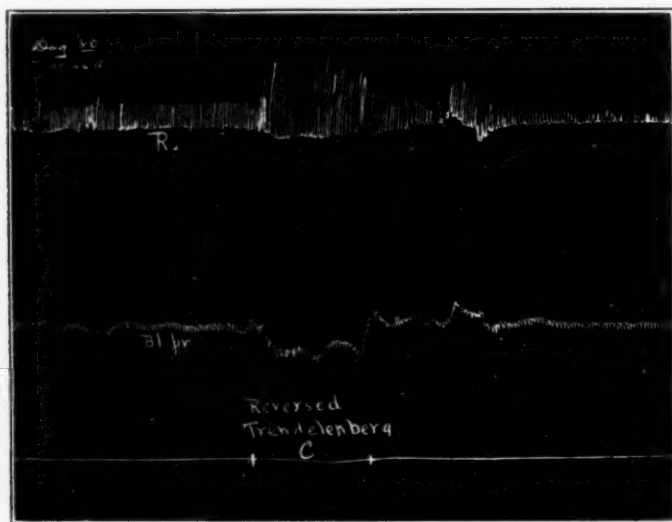


Fig. 2

Figs. 1, 2, 3.—The tracings show the respiratory rate and the blood pressure in changing the position of an experimental dog from the horizontal position to, (A), Trendelenburg position. The respiratory rate and blood pressure is increased. (B) Reversed Trendelenburg (Vertical tail-down) position, dyspnea and a fall in blood pressure. (C) Reversed Trendelenburg position, dyspnea and fallen blood pressure. (D) Trendelenburg position, increased in the respiratory rate and blood pressure. (E). Reversed Trendelenburg position, dyspnea and fall in blood pressure. It will be noticed that in the changes in position from the horizontal position to the positions at A to E that the blood pressure is dropping, which demonstrates the effect of the mechanical factor on the heart.

sided episiotomy, delivery was easily accomplished of a living male child weighing 3225 grams. Placenta expressed at 3:50 A.M. The postpartum course was uneventful, the temperature ranging between 97.6° and 99.4°, pulse from 64 to 88, and the respirations from 18 to 28. Patient was discharged from the hospital on the twelfth day postpartum.

CASE 2.—Mrs. G. H., twenty-six years of age. Multiparae. The patient was seen through the courtesy of Dr. G. K. Rosenweig. Patient was about eight weeks pregnant, cyanosis of the lips and fingers marked, dyspnea, pulse 100, presystolic murmur and an enlarged heart and moist râles over the bases of the lungs. A palpable adenoma of the isthmus of the thyroid.

Diagnosis.—Pregnancy, cardiac failure due to mitral stenosis, and a possible toxic adenoma of the thyroid. An evacuation of the uterus was done on January 31, 1928, in the lithotomy position under gas-oxygen anesthesia. The patient reacted well, and was discharged from the hospital on February 8. The basal metabolic rate six weeks postpartum was plus 8. Patient was advised to be sterilized at a future date.

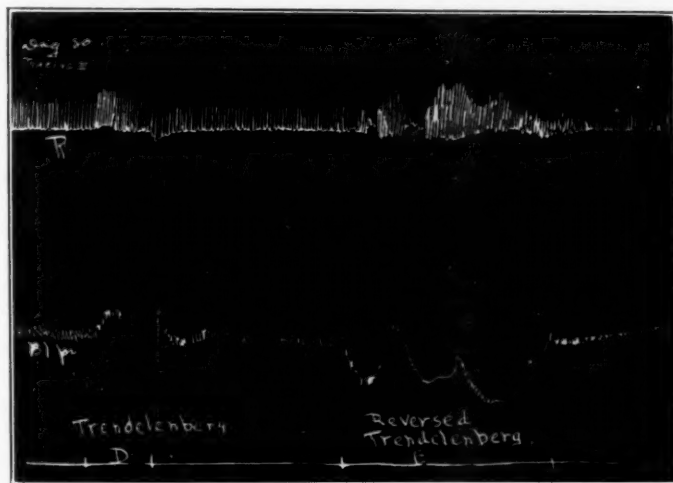


Fig. 3

In view of the fact that the cardiac failure was due to the toxemia in early pregnancy, evacuation of the uterus was done, but if cardiac failure occurs later in pregnancy it should be treated first.

The patient was seen again November 1, 1930, and found to be pregnant about eight weeks. The patient stated that she had been enjoying good health, and was desirous of having another child. Evacuation of the uterus was advised. On November 5, the patient was placed in the lithotomy position, and while being prepared, she suddenly became markedly cyanotic and dyspneic. The patient was placed in a sitting position for about thirty minutes when the cyanosis and dyspnea disappeared. She was placed in a semirecumbent position of 45 degrees, and under gas-oxygen anesthesia the evacuation of the uterus was completed with no further evidence of cyanosis or dyspnea. She was kept in a semirecumbent position for three days and discharged on November 10.

COMMENT

The cardiorespiratory system is interfered with by posture due to the gravid uterus interfering with respiration. The respiratory interference

has been shown by Yandell Henderson to affect cardiac function, and with its resultant decrease of the flow of blood to the heart, brings about a stagnation of blood in the splanchnic vessels, so that gravity shock may occur during labor, and particularly after the delivery of the child, collapse and death may occur. I feel convinced that most of the cases of collapse and death of the cardiopath is due to gravity shock, and is the factor that must be prevented during pregnancy and labor.

During pregnancy the patient should be advised to sleep in a semi-recumbent position in order to avoid interference with the excursion of the diaphragm, and so interfere with respiration.

During labor the patient should be kept in a sitting posture. The delivery should be accomplished in the same posture, and prophylactic forceps done in the second stage of labor in all cardiopaths. Immediately after the delivery of the child sandbags should be applied to the abdomen to prevent splanchnic engorgement. Pituitrin is given as necessary, as well as ergot. The patient should be kept in a sitting posture for at least three days, and gradually brought back to a recumbent position while noting the effect on the cardiorespiratory system.

Vital capacity should be ascertained as a routine in the prenatal examination as an early gauge of myocardial insufficiency.

SUMMARY

The principles involved in the management of the cardiopath on the basis of the author's experience are: (1) a thorough knowledge of the cardiorespiratory physiology as related to posture; (2) the use of every known aid in relieving the embarrassed heart of avoidable strain; (3) to obtain the opinion of a cardiologist as to the condition of the cardiorespiratory apparatus, keeping in mind that the obstetrician on the basis of his obstetric judgment must decide when and how to interfere in a given case for the safety of the patient.

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(For discussion, see page 610.)

PLACENTA CIRCUMVALLATA. A THEORY OF FORMATION
INCLUDING RELATIONSHIP TO NORMAL PLACENTA, TO
PLACENTA MARGINATA AND TO PLACENTA MEM-
BRANACEA. PRELIMINARY REPORT*

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University of Chicago)

MUCH study has been spent on placentation in relation to anomalous location or site such as results in various types of ectopic pregnancy, tubal, ovarian, abdominal, etc. Practically no thought has been given to the subject of the area over which placentation may take place or the changing relation of the size of the placenta to that of the uterine cavity as pregnancy advances. This is remarkable because of the complications which may arise from having too small or too large an area over which the placenta extends in the early months of pregnancy. This subject deals entirely with too large an area.

The first question to arise will be, is there a possibility of having too great an area of placentation. We know of one condition in which this is definitely proved; i. e., placenta membranacea where the fetus at term is entirely surrounded by active placenta except at one small area over which stretch the membranes composed of amnion, chorion laeve and decidua capsularis. This condition represents almost the extreme area over which the placenta could occur and must originate in the early months of pregnancy following which the placenta is distended as the gestation sac enlarges. On the other hand, placentation usually extends over merely a small area of one wall or side of the uterine cavity (it has been stated one-fourth of total area of uterine cavity) so that as the cavity enlarges the area covered grows gradually into that of a normal full-term placenta without undue stress or strain.

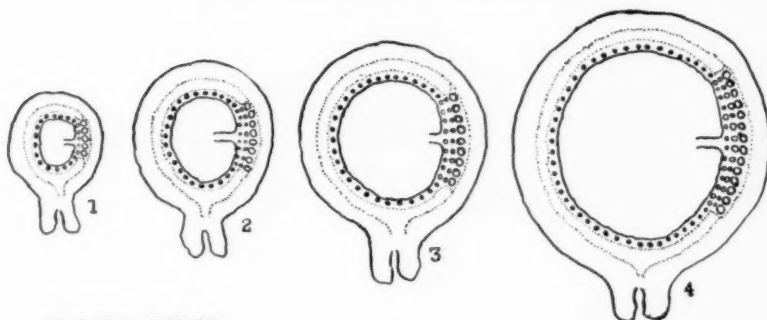
Placentation occasionally must extend over an area larger than normal in the early months because in placenta membranacea it extends over almost all the cavity. What happens to the excess placenta when short of producing a membranaceous placenta; in other words what becomes of the excess marginal tissue? While we may see a full-term placenta extend over nearly all the uterine cavity, we never see one which extends over only half. Something must occur to reduce this, else we would see not infrequently a hollowed out hemispherical placenta at term, one never described to my knowledge.

Consider now what must occur in such a condition. As the fetus enlarges it bulges more and more into the membranes because they are more distensible than the complicated fixed structures in the placenta. Now as the nonplacental portion of the uterine muscle is stretched more than that over the placenta there arises a tension at the margin of the

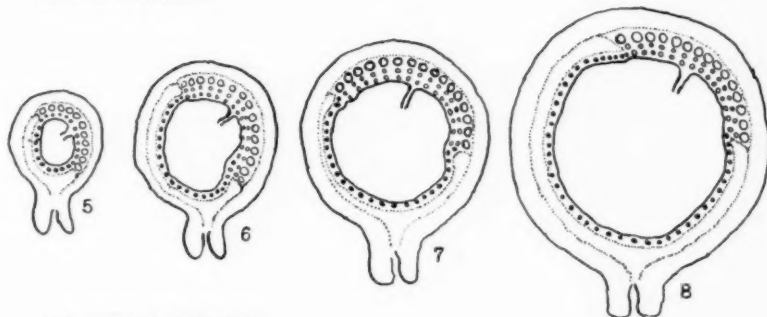
*Read at a meeting of the Chicago Gynecological Society, May 15, 1931.

placenta caused by the tendency for the muscle to stretch off of the relatively rigid placenta. This constant tension aided probably by Braxton-Hicks' contractions ruptures the fine marginal decidual vessels, causing ultimate atrophy of the associated villi which gradually retract into a fibrous ring always at the margin of the placenta. This tension continues until the placenta is reduced to the proper size to care for the optimal nourishment of the fetus. Such a placenta at term is known as placenta marginata.

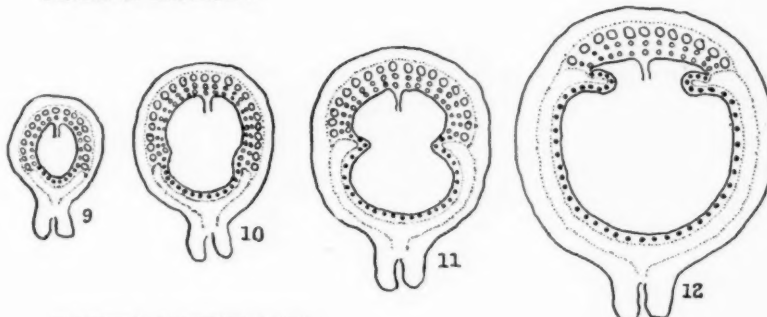
Let us now suppose that early placentation extends over more than half the cavity of the uterus. If the placenta covers not too large an area of the uterine cavity the tension of the growing fetus on the membranes is such that it protrudes from the placental cavity into the more distensible cavity surrounded by the membranes. Now as tension on the muscle wall over this area increases, there is a tendency for the muscles to slip off the margin of the placenta causing a so-called "infaret" ring as above described. This fibrous ring cannot expand. As the fetus enlarges it gradually herniates from the relatively rigid nondistensible cavity surrounded by the placenta into the freer distensible cavity of the expansible membranes. The tension on the muscle covering this latter cavity increases and the pull of the muscle tending to slip off the margin of the placenta continues. Consequently there is a slow separation of the margin of the placenta as the ring traverses back over the emerging fetus. This separation takes place through the decidua so that a layer of the latter covers the anterior surface of the "infaret" ring as is found in all specimens and was ever a source of considerable difficulty in explaining its presence in this position. As the extraplacental cavity is enlarged by the growth of the fetus, the ring with its veil is gradually approximated to the placenta and is found in various stages of agglutination and in various stages of obliteration of its component parts depending on the pressure and the time elements. Such a placenta at term is known as placenta circumvallata. The veil in the best preserved specimens then is composed as follows from its maternal to its fetal surface: (1) amnion, (2) chorion frondosum atrophied into so-called "infaret" ring or white necrosis of villi, (3) a thin layer of decidua (torn loose from the decidua basalis at the margin), (4) a thin layer of decidua capsularis, (5) chorion laeve, (6) amnion. The ring, the annulus fibrosus, is composed of the "infarcted" atrophic and often obliterated chorion frondosum with a thin layer of decidua basalis from the uterine wall external to the remaining active placenta. If the muscle tension is greater on one side of the herniating cavity as the fetus emerges from the "placental cup" into the cavity surrounded only by the membranes, there is formed an eccentric ring or simply a ring fold on one margin only, the muscle tension having been greater here, more "infarction" occurs at this point. Such results are frequently seen in partial placenta circumvallata and in partial placenta marginata or in combinations of the two.



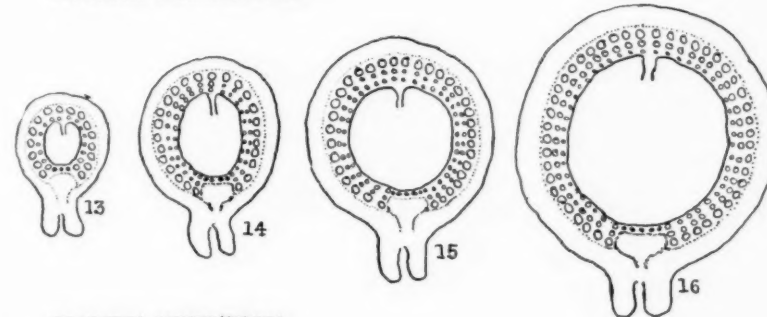
PLACENTA NORMAL



PLACENTA MARGINATA



PLACENTA CIRCUMVALLATA



PLACENTA MEMBRANACEA

Fig. 1.—Schematic chart illustrating development of the placenta in the four theoretically possible types of extent of area of early placentation. In all figures the uterine wall is represented by outside unbroken line; decidua by fine dotted line; dead chorionic villi of chorion laeve or of the "infarct ring" by heavy black dots; active chorionic villi by small circles and amnion by inner unbroken line. 1, 5, 9, 13 represent the early stages of the four types, respectively; while 4, 8, 12, 16 represent the terminal stages. 5 to 8 and 9 to 12 outline the theoretical reduction in the relative size of the placenta as gestation advances with formation of the "infarct rings" as labeled.

If the extent of the early placenta is such that the fetus cannot make enough pressure on the small surface of the membranes to grow out of its placental inclosure it must needs distend it which apparently occurs in placenta membranacea. Probably most of these feti do not survive.

The idea so far embodied may be stated in various ways. The four forms noted, normal placenta, placenta marginata, placenta circumvallata and placenta membranacea are the results respectively of the degree of extent of area of early placentation. Placenta marginata and placenta circumvallata are merely the result of atrophy of the marginal chorionic villi covered by a thin layer of decidua basalis from which the muscle and outer layer of decidua have been pulled off, giving rise to the annulus fibrosus which has caused difficulty in former theories. It may also be stated thus: placenta marginata and placenta circumvallata are the results of the effort of nature to convert excess placental tissue into passive membranes. They each contain the same elements and ordinarily the line of demarcation is determined early. However, it is not unreasonable to expect a certain per cent of error in its early determination due probably to excessive vascularization of the decidua in certain locations in the uterus.

Assuming that the foregoing theory represents the facts, it is suggested that normal placenta results when the fertilized egg embeds in the decidua of the relatively flat anterior or posterior wall of the uterus in which case there is decidua basalis roughly on one side of the ovum only; that placenta marginata results when it embeds in the decidua at the extreme lateral margin of the cavity where the anterior wall reflects onto the posterior wall in which case there is decidua basalis roughly on two sides of the ovum and that placenta circumvallata results when it embeds in one of the uterine cornua in which case decidua basalis occurs roughly on three sides. If the egg should embed far enough in the depression of the horn there might result placenta membranacea; still farther would result in uterointerstitial pregnancy (Klebs). Indeed it is possible that as placenta membranacea is very rare, it may be the end-product of an interstitial pregnancy implanted close to the uterine cavity but still deep enough for a good maternal blood supply to all sides of the ovum. The chorion frondosum and subsequently placenta develops over the whole ovum and then the further growth of the gestation sac gradually takes place into the uterine cavity.

If the theory represents the facts a study of a series of midterm pregnant uteri, Porro operation or necropsy specimens hardened before mutilation should show a variation in relative area of placentation; about 85 per cent extending over possibly one-fourth of the uterine cavity; about 14 per cent should have placenta extending over approximately one-half of the uterine cavity and about 1 per cent or 1.5 per cent with the placenta extending over about three-fourths of the uterine cavity. This is about the ratio of occurrence of normal placenta, placenta marginata and placenta circumvallata given in Williams' comprehensive review of the subject. Placenta membranacea is very rare, only a few cases having been reported.

Facts pertinent to this theory, photomicrographs, illustrative plates, review of literature, etc., will appear in a separate paper.

For their interest and many valuable suggestions I wish to thank Dr. Carey Culbertson, Associate Professor of Obstetrics and Gynecology, Rush Medical College, and Dr. George W. Bartelmez, Professor of Anatomy, University of Chicago.

(For discussion, see page 611.)

THE BACTERIOLOGY AND PATHOLOGY OF CHRONIC CERVICITIS*

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I. INTRODUCTION

THIS investigation of chronic cervicitis deals with the bacteriologic examination of organisms in the depths of the tissue and also with the histopathologic study of the sections.

It is accepted that chronic cervicitis is due to a persistent infection in the depths of the compound racemose glands, which is characterized pathologically by a periglandular round cell infiltration. The cervix is prone to infections because of its situation in the vagina and because it is lacerated during labor. The crypts and lacunae of the mucous membrane of the cervical canal afford a protection for the invading organisms and in this gonococci may lie dormant for long periods. Instrumentation, childbirth, postabortal infection, sex trauma, prolonged wearing of pessaries, repeated reinfection from a chronic prostatitis, retrodisplacements, and other conditions causing a pelvic congestion, are important contributory causes of chronic cervicitis. It may also occur following vulvovaginitis in children, or the exanthemata, especially scarlet fever and diphtheria. Septic sore throat, and the general debilitating diseases may contribute to it also. The cervix following the initial gonorrheal infection, or injury forms a favorable habitat for the secondary invaders.

Investigators are agreed to the various organisms that are found on the surface of the pathologic cervical canal, but no mention has been made of the bacterial flora in the depths of the glands. It has been shown by Pilot and Davis¹ that the hemolytic streptococci were recovered in 58 per cent of the throats of individuals with normal tonsils, while the nonhemolytic type was present in almost 100 per cent of the tonsils. From the crypts of the hyperplastic tonsils, the hemolytic streptococci were obtained in 98 per cent. It was conceivable that a similar condition should exist in the cervix which would account for the persistent inflammatory condition.

II. REVIEW OF LITERATURE

It is a well-established fact that the normal genital tract above the external os is germ free. Winter² placed the boundary between the germ free and germ containing portions of the genital tract at the internal os. But Menge,³ Walthard,⁴ and

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Read at a meeting of the Chicago Gynecological Society, May 15, 1931.

I wish to express my appreciation to Dr. F. H. Falls, Dr. L. Arnold, and Dr. N. M. Percy for their kind assistance.

Stroganoff⁵ have shown it to be lower down in the region of the external os. Menge⁶ estimates that the bacteriocidal properties of the cervix are extremely high. He proved this by the inoculation of the staphylococcus and streptococcus into the cervixes of 15 women. After a maximum of twelve hours the secretion of the cervix which is alkaline was sterile again.

Infection of the cervix frequently dates back to a vulvovaginitis in early infancy²⁵ according to Hess.

According to Menge⁶ in adult females 95 per cent of chronic gonorrheal infections are located within the cervix, and in about 80 per cent of the acute cases.

Polak²⁶ maintains that fully 85 per cent of all women, single or married, have infected cervixes.

Fulkerson⁸ reviewed 6,483 gynecologic records of Cornell University Medical School and found a diagnosis of cervicitis or endocervicitis in 2,150 cases, or 33.16 per cent. The preponderance of married women who had borne children, or had miscarried, was 80.1 per cent together with a small number of single women. Fulkerson's statement supports the conclusions that the traumatism of labor or abortion is the chief factor in producing the disease. Therefore gonorrheal infection is not as frequent an etiologic factor as usually supposed.

The incidence of cystic cervicitis at the Mayo Clinic⁹ according to Masson and Parson is less than usually reported, occurring in 2,368 cases, or 1.05 per cent of 226,900 women examined for all conditions. Two hundred and eighty-three microscopic examinations were made in 661 cases, and 66.8 per cent were cystic cervicitis, 24 per cent cystic cervicitis with erosion, in 9 per cent hypertrophic cystic cervicitis, and in 10 per cent, it was stated no malignancy was found. These investigators emphasize that cystic cervicitis is not a simple infection, inflammation, or erosion, but is a process in which these factors have persisted until the final stage of cystic formation resulted.

Curtis¹⁰ is convinced that the hypertrophic cervical glands are a most important factor in chronic leucorrhea. The bacterial flora is fairly uniform and especially anaerobic gram-negative bacilli are most numerous. At least four types of gram-negative diplococci were encountered. Most important of all are the gram-positive diplococci, these may be anaerobic or aerobic and are almost always found in these cases which are subject to recurrent symptoms of acute inflammation. He also found a similar flora, but more varied from the purulent leucorrheal discharge from the vagina. In fresh vaginal smears these cocci are practically always in the form of diplococci. On artificial media they form very long chains composed of oval or lancet-shaped cocci in diplo-arrangement. The cocci of the different strains are subject to much variation in length, and may assume extremely long bacillus shapes. They also occur in pairs, tetrads, or short chains. Curtis states that he has encountered these gram-positive aerobic and anaerobic cocci in 30 per cent of his patients with chronic purulent leucorrhea. Their presence increases the danger of infection following instrumental abortion greatly, and they are responsible for many idiopathic puerperal infections, especially if there has been a cervical laceration extending into the broad ligament.

Arnold and Brody¹¹ in a study of 262 stains of gram-positive cocci from the cervical canal isolated staphylococcus 70 times, the enterococcus 96 times, the nonhemolytic streptococci 84 times, and the hemolytic streptococci 12 times. The average limiting H ion concentration of the enterococcus was P_H 5.0, the variations were between P_H 4.7 and P_H 5.6, and were therefore within the human or pathogenic range. They found that the vaginal bacterial flora resemble in many respects certain fecal types; that the gram-positive cocci of the cervical canal differ from those found in the vagina. Also there is a gradual loss of power of the cervical enterococcus to ferment mannite, which is so typical of fecal strains, and they become more pathogenic for mice. They attribute both of these differences to the more

parasitic mode of existence of the organisms in the cervical canal under the conditions found in their cases.

Dible¹² examined 152 stains of fecal streptococci by utilizing Andrewes and Horder's¹³ sugar fermentation test (dropping neutral red as not reliable from his experience). Yules' coefficient, and Houston and McCloy's heat resistance test, through which he was able to divide them into four groups: (1) A mannite fermenting group. (2) A raffinose or inulin fermenting group. (3) A "combined" group comprising types which split mannite, as well as raffinose, or the polysaccharide inulin. (4) An undifferentiated group which lacks action on any of these substances.

His Group I corresponds to the central group of Andrewes and Horder's, but his other groups show the weakness of Andrewes and Horder's classification, as the variants are nonmannite fermenters, but heat resistant. Therefore they belong to the class of "enterococcus." This term he selects in preference to *Streptococcus fecalis* which he maintains is confusing in that all fecal streptococci are not *Streptococcus fecalis*. These strains tested for pathogenicity by injecting mice and rabbits gave apparent negative results.

Moench¹⁴ points out that chronic arthritis may follow chronic endocervicitis. Eighty-two miscellaneous cases with leucorrhea were studied bacteriologically, 38 strains of which were used for animal inoculation. Cultures were made from the cervical canal with sterile swabs. The organisms encountered were found to correspond closely with the classification of bacteria, isolated by Curtis from his studies on the vaginal and cervical flora encountered in chronic leucorrhea. The short chain anaerobic diplostreptococci in fluid medium assumed a large number of elements, and on subculture tended to lose their irregular staining and become aerobic. The aerobic streptococci encountered appeared as lanceolate diplococcus, with but slight tendency to grow in chain formation. These organisms were pathogenic for animals and showed marked affinity for joints.

From a case of progressing arthritis with absence of other foci of infection, Moench showed that the specificity of the organisms depended upon its virulence and environment. In 98 per cent of the rabbits inoculated with the anaerobic streptococci (obtained by dissecting away first the glandular cervical mucous membrane, and then macerating the cervical myometrium with the basal glands) the organism had a marked specificity for joints as against 54 per cent of a series inoculated with the aerobic strains obtained from the cervical mucous membrane of the same patient. From this experiment Moench regards the aerobic strains as modified forms of the more highly virulent and more definitely specific anaerobic streptococci, which are deeply embedded in the submucous muscular tissues of the infected cervix.

Sturmdorf¹⁵ maintains that the cervical lymphatics convey an infection throughout the muscular planes, as an ascending lymphangitis and invades the contiguous adnexa, thereby inhibiting their normal function. He characterizes the cervical mucosa as the uterine tonsil, as he considers chronic endocervicitis as primarily and essentially an infection of the deeply situated terminal tufts of the endocervical muciparous glands. Microscopically the sections reveal according to Sturmdorf a hyperplasia of the lymph vessels with surrounding round cells, and milary abscesses in the musculature of the portio. There are also streaks of dense round cell infiltration peri-glandular, subepithelial and intermuscularly. The distention of the glands he maintains is due to the occlusion of the ducts and produces the Nabothian cysts. These may honeycomb the cervical structure or becoming purulent riddle it with milary abscesses.

Matthews¹⁶ substantiates Sturmdorf's contentions. He further shows that sections from the excised cones beginning at the external os reveals marked inflammatory changes, but as the internal os is approached, these changes are barely present or are entirely absent. He calls attention to the efficiency of Sturmdorf's method insofar as the removal of the infected area is concerned.

Koster²⁷ says tracheloplasty as advocated and practiced by Sturmdorf would seem to be the logical form of treatment. In undoubted cases of chronic endocervicitis by this technic, a piece of tissue was excised from the new cervical canal before relining with the mobilized vaginal cuff. This section microscopically showed glandular elements and surrounding inflammatory reaction, similar to the tissue removed in the cone-shaped wedge. Koster feels that the Sturmdorf operation does not remove the infected area entirely.

Kennedy¹⁸ states that Adami summing up Hohnfeldt's observation on the process occurring in a suppurative inflammation that ends in healing and encapsulation of the debris of leucocytes, and micrococci, did not state whether the micrococci remaining were dead or alive. Kennedy states that the reviewed literature up to 1921 did not answer this question, and it is doubtless due to the difficulty in demonstrating bacteria in round cell infiltration of such small volume. In a review of the literature to date I have been unable also to find any reference on demonstrating bacteria in chronic cervicitis. Kennedy further states where there is leucorrhea there must be an interstitial irritant, and this is most probably produced by the toxin from the bacteria in the foci of the round cell infiltration.

Harris¹⁰ reports in 223 cesarean sections performed in the obstetrical service of Johns Hopkins up to May 15, 1922, supracervical hysterectomy was performed sixty-four times. Of these forty were subjected to histologic study, and in twenty-three of them definite histologic evidence of ascending infection was found. This was characterized by leucocytic infiltration or actual inflammatory reaction in the mucosa of the cervix and lower uterine segment. In many specimens the presence of bacteria were demonstrated by suitable stains. According to Harris the bacteria were present in the supravaginal portion and most intense there. Therefore this investigator states it is safe to assume that in the presence of an ascending infection the entire cervix would certainly be involved (personal communication).

III. BACTERIOLOGIC AND PATHOLOGIC TECHNIC

The cervical tissue was enucleated by Sturmdorf's technic, using either the radio knife or the scalpel. The sterilized enucleated cervix was immediately placed in a small sterile glass jar with a cork stopper and were examined within one-half to two hours. The technic employed for the grinding of the tissue under aseptic conditions was that described by Maryan²⁰ in a previous communication. In the early part of the work, the outer surfaces of the tissue were sterilized by searing it through the flame before grinding, but thereafter the tissue was sterilized by holding the tissue into boiling water for 15 seconds. This was found easier and equally efficacious.

Media: The culture media used was dextrose infusion broth 2 per cent, bactodehydrated medium veal infusion of P_H 7.3, blood agar (human blood 10 per cent), plain agar and egg yolk agar plates. At times 20 per cent ascitic fluid was added to the veal infusion and to the blood agar plates. Throughout the work veal infusion was used mainly. Test tubes containing 10 c.c. of veal infusion for the inoculation from the surface, and small flasks containing 100 c.c. for the ground tissue were used. Cultured aerobically and anaerobically at 37.5° C., from twenty-four to forty-eight hours or longer. The pyrogallie acid potassium hydroxide method in a dessicator was used for anaerobiosis. The terminal hydrogen-ion concentration was determined between five or ten days incubation.

The sugar fermentation reactions of 1 per cent using Brom cresol purple as an indicator were tested by utilizing Gordon's,²¹ Andrewes and Horder's,¹² Holman's,²⁴ and Dible's¹³ sugar fermentation classification. The sediment was observed in 100 c.c. plain broth in a small flask. The pathogenicity was determined by injecting mice with $\frac{1}{4}$ c.c., $\frac{1}{2}$ c.c., and 1 c.c. of a twenty-four-hour veal infusion culture intraperitoneally.

IV. BACTERIOLOGIC RESULTS

Experiments: From 51 cases, 41 strains of gram-positive cocci or 80.4 per cent were isolated and in the remaining 10 cases, or 19.6 per cent, the cultures were sterile. These organisms are gram-positive and are facultative aerobes. Morphologically, Figs. 1 and 2, they occur predominately as lanceolate, or oval, diplococci surrounded by a halo and in short chains of three to four cocci, but also associated with tetrads and small clusters. They appear pleomorphic, Fig. 3. The cocci assume various

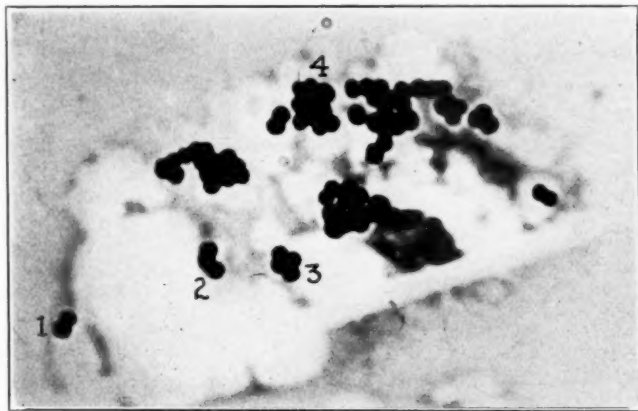


Fig. 1.—Strain 15 ($\times 2000$). *Enterococcus*. (1) Lanceolate diplococci with halo. (2) Short chain. (3) Tetrads. (4) Clusters.

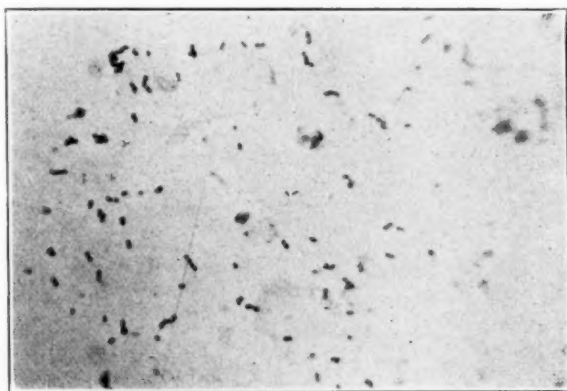


Fig. 2.—Strain 60 ($\times 1380$). Forty-eight-hour aerobic ground culture. *Streptococcus fecalis*.

forms, positions, and appear swollen. They have no capsule. The long chained cocci have also been isolated from nine strains (Fig. 4). Upon blood agar plates they appear as small moderately elevated pinpoint to pinhead moist grayish white colonies, which grow luxuriantly with no discoloration. Four strains showed large whitish colonies with definite hemolysis (probably hemolytic enterococcus, described by Weatherall and Dible.²³ Upon plain agar they grew similarly with no difficulty. The colonies vary in size from 0.3 mm. to 0.7 mm. in diameter. Upon transilluminated light they appear oval, granular, semi-opaque, and surrounded by a narrow clear zone, just within the outside margin of the colony. The sediment in a test tube of veal infusion appears granular and in streaks radiating downward from the surface. The sediment in a small flask of 100 c.c. plain broth appears white, stringy

and mucoid. They are very resistant and can be kept alive without difficulty after several years in original culture. In our laboratory our cultures have been kept alive for six months at 37.5° C. They are saccharolytic. From our study of the carbohydrate fermentation, our strains can be classified only as indicated in Table I into a biologically active group, a biologically inactive group, and the variables. They are heat resistant with standing 60° C. for one-half hour. From five cases the filtrates were prepared according to the technic of Pilot and Afrenow²⁷ to determine the presence of an exotoxin. The skin tests upon women who had chronic cervicitis,

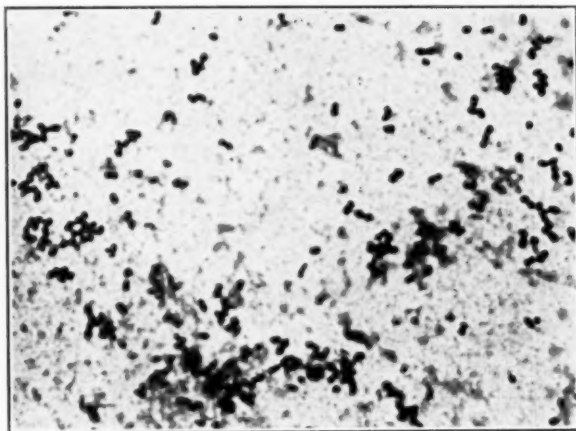


Fig. 3.—Strain 60 ($\times 1380$). Forty-eight hour anaerobic ground culture. *Streptococcus fecalis* with marked pleomorphism.

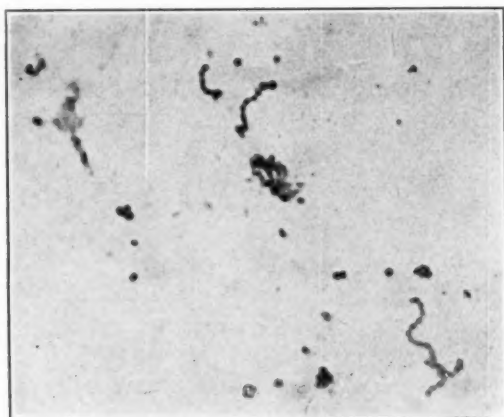


Fig. 4—Strain 55 ($\times 1380$). Long chain enterococcus.

mice injected intraperitoneally with $\frac{1}{2}$ - $\frac{1}{2}$ and 1 c.e. of twenty-four-hour cultures, and five rats injected intraperitoneally with 3 c.e. of the filtrate, were all negative. The terminal hydrogen concentration, after five days' incubation at 37.5° C. determined by the Hellige²⁸ method, ranged from P_H 4.3 to P_H 6.7.

Out of a series of 72 mice, 12 died, and the same organisms were recovered from the blood of the heart in all.

The organisms described correspond morphologically and biologically with the *Streptococcus fecalis* or enterococcus of Dible,¹² or the enterococcus described by Arnold.¹¹ Therefore we call it the enterococcus (Table II).

TABLE I. SUGAR FERMENTATIONS

STRAINS	DEXTROSE	LACTOSE	MALTOSE	LITMUS MILK COAGULATED	MANNITE	SALICIN	NITRATE	GLYCERIN	GELATIN	ARABINOSE	SACCHAROSE	RAFFINOSE	INULIN	DULCITE	
34	+	+	+	+	-	+	+	+	+	-	+	-	-	-	
42	+	+	+	+	+	+	-	+	+	-	+	-	-	-	
44	+	+	+	+	+	-	-	-	+	-	-	+	-	-	
41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
39	+	+	+	+	-	-	+	+	-	-	+	-	-	-	Hemolytic
51	-	-	+	+	-	-	-	-	+	-	+	+	-	-	
57	+	-	+	+	+	-	+	-	+	-	+	+	-	-	
43	-	-	-	-	-	+	-	-	-	+	+	+	-	-	

TABLE II. DIFFERENTIAL TABLE OF GRAM-POSITIVE COCCI

	STAPHY- LOCOCCUS	STREPTOCOCCUS FECALIS	ENTEROCOCCUS	PNEUMO- COCCUS
Morphology	Clusters large and small	Diplococcus lanceolate and short chains	Diplococcus lanceolate short chains tetrads and small clusters	Diplococcus lanceolate
Capsule	Negative	Negative	Negative	Positive
Mannite	Negative	Positive	Negative	Negative
Inulin	Negative	Negative	Negative	Positive
Bile Solubility	Negative	Negative	Negative	Positive
Heat Resistance	Negative	Positive 60° C. for 30 minutes	Positive 60° C. for 30 minutes	Negative
Mouse Pathogenicity	Negative	Slight	Slight	Very
Longevity	Negative	Very—months to several years	Very—months to several years	Short

V. INTRODUCTION TO PATHOLOGY OF CERVIX

There is considerable divergence of opinion regarding the fundamental pathology and histopathologic picture in chronic cervicitis. Some authors claim that only the mucosa is affected by the inflammation, while others believe that associated changes in the myometrium give evidence that more than the mucosa is involved in the process, and that this involvement has a real clinical significance.

From a review of the literature one gathers that chronic cervicitis is a persistent infection in the depths of the compound racemose glands with associated cellular infiltration and proliferation. The greatest involvement may be in the intracellular infiltration, glandular prolifera-

tion, exudation, edema and vascular engorgement. Again the involvement may also be a mild subepithelial, periglandular or scattered round cell infiltration with some glandular increase. The section appears almost normal. But usually chronic cervicitis is that of a progressive persistent infection with its diffuse periglandular round or plasma cell infiltration interstitially and perivascular. There is also marked glandular proliferation, vascular engorgement, dilated lymph spaces, with localized lymphoid tissue in the musculature, and a fibrosis of the musculature. Usually associated with these findings are the erosions in various phases.

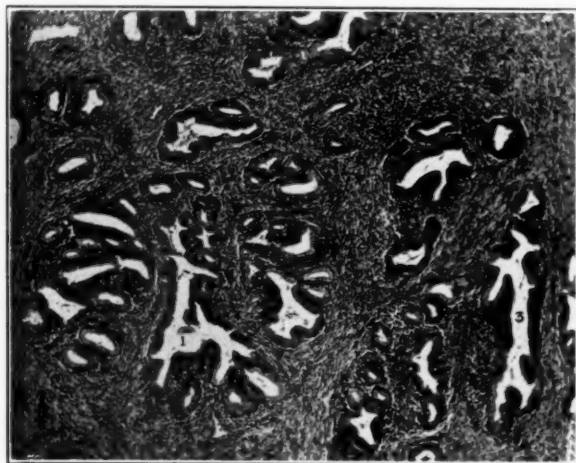


Fig. 5.—Section 59 ($\times 95$). (1) Hypertrophy and hyperplasia of glands with scattered periglandular round cell infiltration. (a) Papillary projections into lumina. (2) Interstitial edema. (3) Extent of gland deep into stroma.

VI. PATHOLOGIC TECHNIC AND RESULTS

The object of this study was to determine the organisms in the depth of ground-up cervical tissue and to correlate these findings with the histopathologic changes in the depths of the glands of the endocervix; also whether or not organisms could be demonstrated in the tissues by suitable stains.

This report relates to 49 gynecologic patients complaining mainly of leucorrhea, and showing grossly definite evidence of chronic cervicitis. Thirty-nine of the sections were those in which the bacteriologic cultures were positive, and 10 of those in which the cultures were sterile. In some cases pelvic infection or retrodisplacements were also present. There were several nullipara, but the majority were multipara with concomitant lacerations and relaxations. A few of our cases had previous cauterizations and a few showed cicatricial obstruction of the cervical canal. Several cases gave a history of previous gonorrheal infection and several others were verified in our venereal clinic. From a few cases of procidentia the sections were obtained from the amputated cervical lips.

Paraffin sections were stained with hemotoxylin and eosin, and Van Gieson methods for general study. The Gram-Weigert, Levaditi (especially for spirochetes), Brown and Brenn,²⁴ and Wolbach-Giemsa stain for the demonstration of the bacteria.

Microscopic sections display the disturbed equilibrium between the endocervical glands and the subepithelial stroma. The histology in most instances displays the superficial stroma, rich in newly formed widely dilated capillaries with a moderate to intense round cell infiltration. The glands are hyperplastic and hypertrophic, Fig. 5, and many are dilated even to the point of forming cysts. Other sections show slight to moderate glandular proliferation with desquamation of the glandular epithelium. Usually some of the hypertrophic glands extend considerably into the fibromuscular tissue. The glandular epithelium usually shows papillary projections

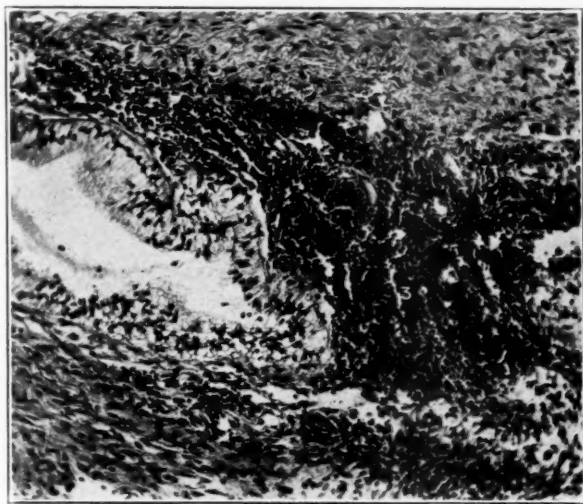


Fig. 6.—Section 43 ($\times 250$). (1) Hypertrophy of gland with stratification of glandular epithelium. (2) Vacuolization and displaced nuclei. (3) Characteristic periglandular round cell infiltration.

extending into the lumina. The glandular lumina usually contain granular or homogeneous pale unstained debris. The nuclei of the glandular cells (Fig. 6) may be displaced, distorted and show several layers or more of polygonal cells. The glandular epithelium may also appear stratified with scattered or absent nuclei. The periglandular stroma fibers are usually widely separated as a result of interstitial edema, and a periglandular round cell infiltration is commonly seen. This may be sparse or very dense and appear on one part of the gland as a focal area, or at times invading the basement membrane of the glands.

The deep stroma was frequently the seat of small to moderate perivascular round cell infiltration, Figs. 7 and 8, especially seen invading the perivascular lymph sheaths. Otherwise it usually displays fibrosis, hyalinization, or atrophy. Frequently focal areas of round cell infiltration were encountered.

In a number of sections coalesced cystic glands deep in the stroma associated with normal looking glands were seen, within other parts of the same section evidence of chronic inflammation, such as described above, was present. These are interpreted as recurrent types of chronic cervicitis.

Three of the sections showed an intense round cell infiltration invading the endocervix (Fig. 9) and musculature with marked desquamation of glandular epithelium. In these sections were seen mixed polymorphonuclear leucocytic and

round cell infiltrations, forming small abscesses in the stroma. The abscesses, Fig. 10, were usually situated in the subepithelial area. In one case they were encountered in the stroma of the papilla of the gland. These sections also showed hyperchromatic cells, plasma cells and eosinophiles.

In a number of the sections were found glandular and follicular erosions, associated with the above-described pathology. The sections that were enucleated by

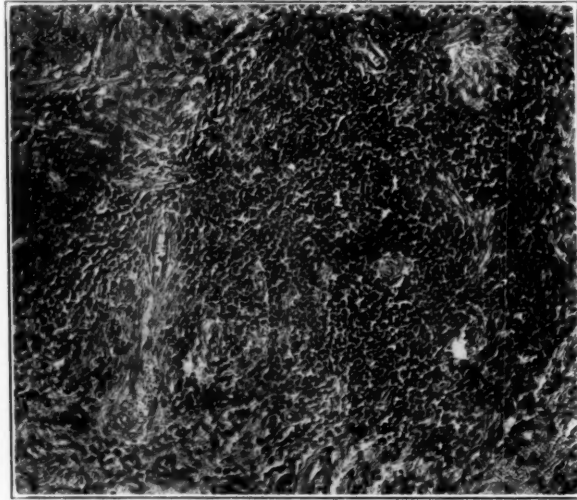


Fig. 7.—Section 18 ($\times 220$). (1) Diffuse interstitial round cell infiltration of musculature. (2) Diffuse perivascular round cell infiltration.



Fig. 8.—Section 2 ($\times 450$). (1) Perivascular round cell infiltration. (2) Round cell infiltration of perivascular lymph sheaths.

the radio knife showed, liquefaction necrosis. The sections in which the cultures were sterile gave similar pathologic findings. This can be accounted for by several factors, either the organisms were of such very low virulence that they could not be reactivated by culture, or else they may have been killed by the exudate or tissue products. It is also possible that these cases are those which may have occurred from mechanical or chemical irritation.

We were unable to demonstrate by staining methods bacteria in the tissues. It was thought possible that by our routine bacterial stains, Gram-Weigert, and Levaditi, there might have been a possibility of overlooking them. Therefore the Brown-Brenn differential stain, and the Wolbach-Giemsa stain were used as a means of a check upon the same sections in a large number of cases.



Fig. 9.—Section 42 ($\times 52$). Extensive round cell infiltration of endocervix. (1) Glandular desquamation. (2) Focal areas of necrosis. (3) Round cell infiltration of musculature.

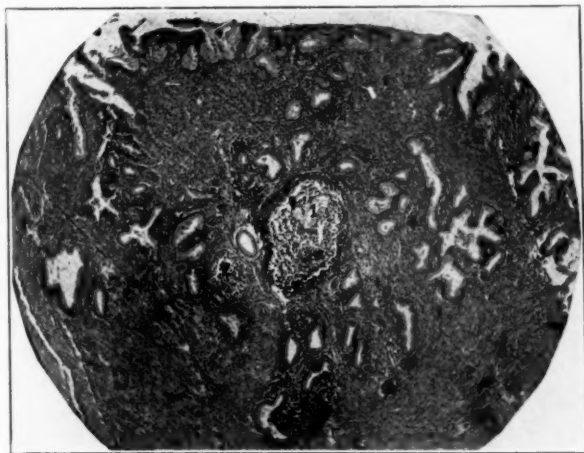


Fig. 10.—Section 37 ($\times 66$). Recurrent endocervitis. (1) Miliary abscess. (2) Focal area of round cells with focal area of necrosis. (3) Marked periglandular round cell infiltration of musculature. (4) Hypertrophy and hyperplasia of glands.

Our negative bacterial findings are in accord with the consensus of opinion of other investigators that it is extremely difficult to demonstrate bacteria in chronically inflamed tissues.

The correct term for chronic inflammatory invasion of the cervix is cervicitis. It designates pathologically that the deeper structures have been invaded by inflammatory infiltrations and glandular proliferations. This is borne out from the study of our sections.

VII. SUMMARY

1. The organisms isolated are the enterococcus.
2. Because of the methods employed we feel that the organisms isolated are from the depths of the compound racemose glands.
3. These organisms are highly heat resistant, of relative low virulence and tendency to live long.
4. In 80.4 per cent of cases the cultures were positive and in 19.6 per cent they were negative.
5. Paraffined sections stained with hemotoxylin, and eosin, and Van Gieson methods were done routinely for general study.
6. The bacterial stains used were: (1) Gram-Weigert, (2) Levaditi (mainly for spirochetes), (3) Wolbach-Giemsa, and (4) Brown and Brenn.
7. No bacteria in the tissues were demonstrated in our series of 49 cases of chronic cervicitis.
8. Microscopic sections reveal mild, moderate, recurrent, and intense cellular infiltration and glandular proliferation of the endocervix and the deeper structures.
9. Glandular and follicular erosions were also encountered in many of the sections.
10. Chronic cervicitis is preferable to the term chronic endocervicitis, as the deeper structures are generally involved.

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SOME OBSERVATIONS ON THE ASCHHEIM-ZONDEK TEST IN THE DIAGNOSIS OF PREGNANCY*

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SINCE the hormonal test for the diagnosis of pregnancy was first suggested by Aschheim and Zondek in 1928, an extensive literature on this pregnancy test has emanated from all parts of the world. The earlier workers busied themselves with experiments corroborating its value, while many of the later authors have concerned themselves with changes and refinements to make it more applicable as a clinical aid in diagnosis. Our work has been confined to the latter.

The physiologic basis for the pregnancy test has been fully covered by the original authors in their numerous writings. A brief review will

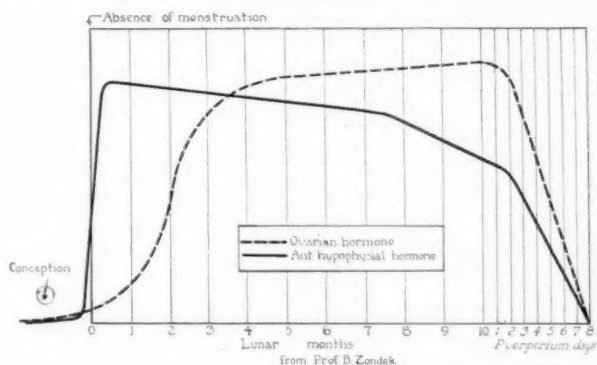


Fig. 1.—A graphic illustration of the concentration of ovarian and anterior hypophyseal sex hormone in urine of women during pregnancy and puerperium.

suffice here. The urine of pregnant women, after the third week, contains an abundance of sex hormone similar to that elaborated by the anterior pituitary gland (Fig. 1). This anterior pituitary sex hormone is nonspecific in that it stimulates either ovaries or testes, causing them to produce their own specific sex hormones. The testis or ovarian hormones stimulate the growth of the sexual organs and hasten sexual maturity. The injection of anterior pituitary hormone or urine from pregnant women in the immature female rat causes maturation of the follicles, massive hemorrhages resulting in the characteristic macroscopic blood points, numerous corpora lutea, and atretic follicles (Figs. 2 and 3). In the male, this nonspecific hormone from the urine produces changes in the secondaries, hypertrophy of the seminal vesicles, prostate, and vas deferens.

*Read at a meeting of the Chicago Gynecological Society, May 15, 1931.

Aschheim and Zondek make use of immature mice as test animals for the demonstration of the anterior pituitary hormone in the urine of pregnant women. Five mice, weighing from 6 to 8 grams, are each given six subcutaneous injections of pregnancy urine, varying from 0.2 to 0.4 c.c. per dose, over a period of forty-eight hours. The animals are

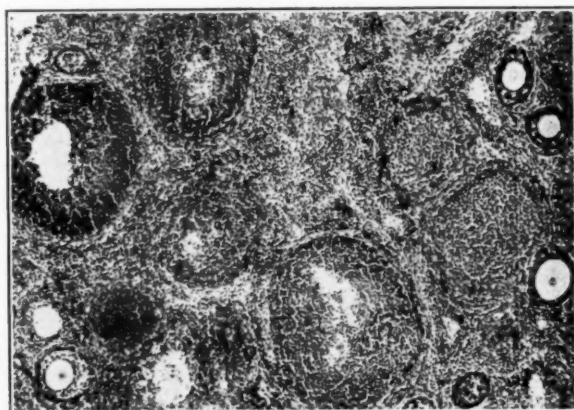


Fig. 2.—Microscopic section from the ovary of an injected rat showing extensive luteinization, but not as marked as in Fig. 3.

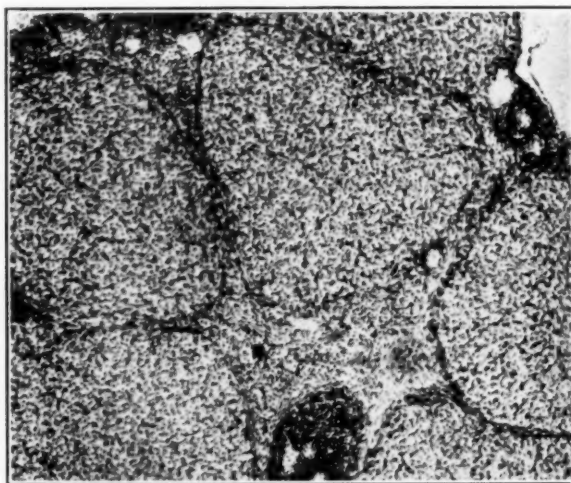


Fig. 3.—Microscopic section from a rat showing complete luteinization of the ovary, the result of injections with pregnancy urine (X 120).

killed at the end of ninety-six hours following the first injection, and the organs are examined macroscopically and microscopically.

Many observers have described modifications of the original method in order to simplify and make it more adaptable to routine clinical use. Friedman injects pregnancy urine in the ear-vein of rabbits, producing typical ovarian findings within from thirty-six to forty-eight hours,

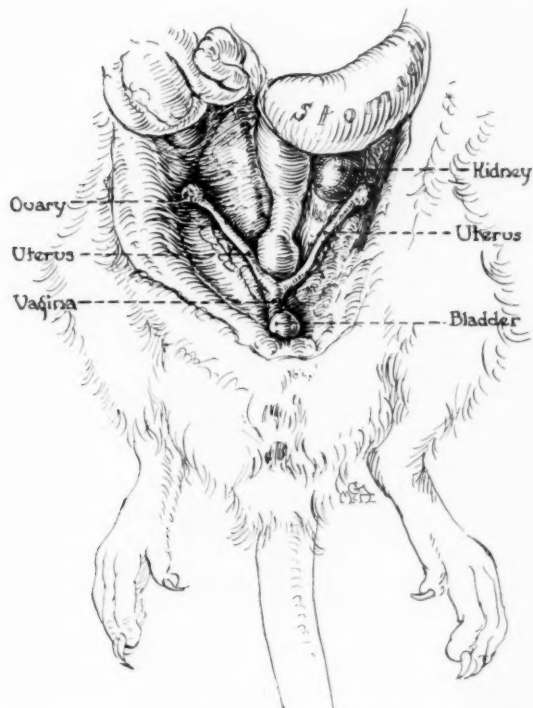


Fig. 4.—Control. Uninjected female rat. Normal genitalia in situ in the immature female rat.

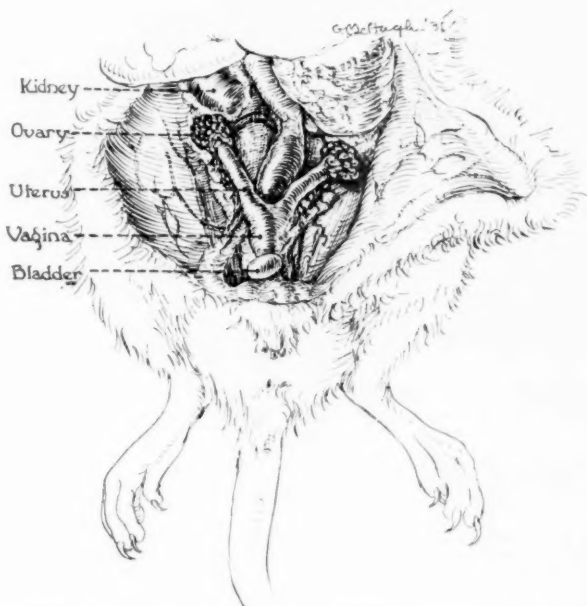


Fig. 5.—Injected female rat, litter mate. Positive reaction. Note the enlargement of the ovaries, the characteristic hemorrhages, as well as the maturity of the entire genitalia.

thereby shortening the test. Mathieu and McKenzie make use of female rats, injecting only one animal with 0.5 c.c. of urine twice daily for three days and examining the genitalia in ninety-six hours. Brouha first suggested the use of male mice, immature and mature. The pregnancy test here depends upon the maturation of the accessories through the stimulation of the gonads by the anterior pituitary hormone in the urine.

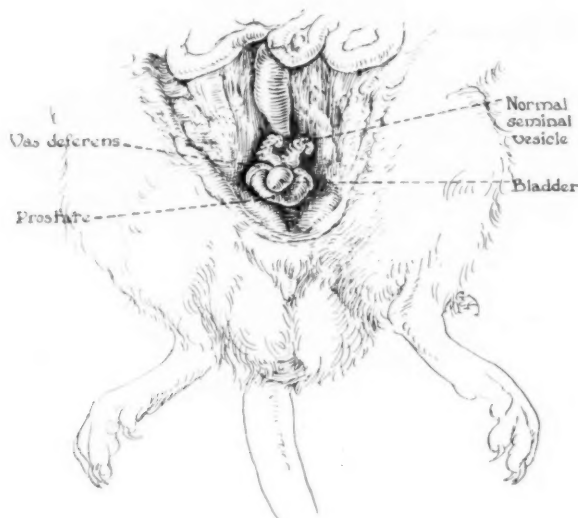


Fig. 6.—Control. Uninjected male rat. Normal male genitalia in situ in the immature male rat.

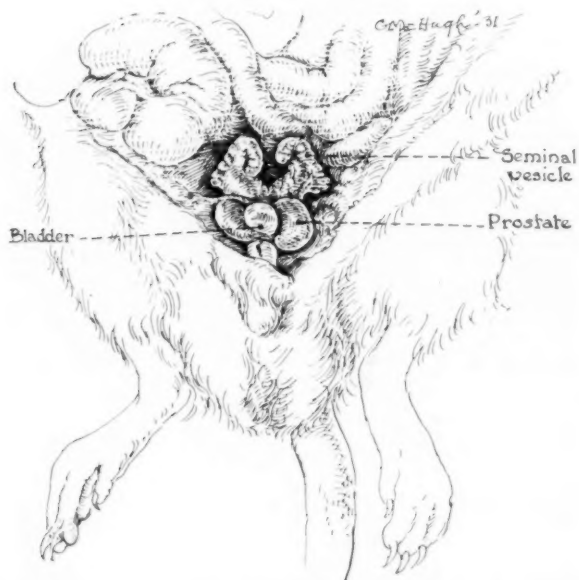


Fig. 7.—Injected male rat, litter mate. Positive reaction. Note the enlargement of the seminal vesicles and prostate.

AUTHORS' METHOD

Immature female rats can be weaned when they are about 20 days old. When they are from 25 to 30 days old and weigh from 30 to 35 grams, they are ideal for the pregnancy test. We prefer three rats which are litter mates, using two for the injection and keeping the largest for the control. The test rats are given two injections each of one cubic centimeter of urine daily for two days. All three rats are anesthetized ninety-six hours after the first injection and the genital organs are examined in situ and compared with those of the control.

The following changes may be noted in a positive test for pregnancy:

The ovaries of the injected rats are grossly enlarged, irregular in outline, and hyperemic. On the surface one can note small hemorrhagic areas—the blood points. The accessories are also enlarged and congested in comparison with those of the

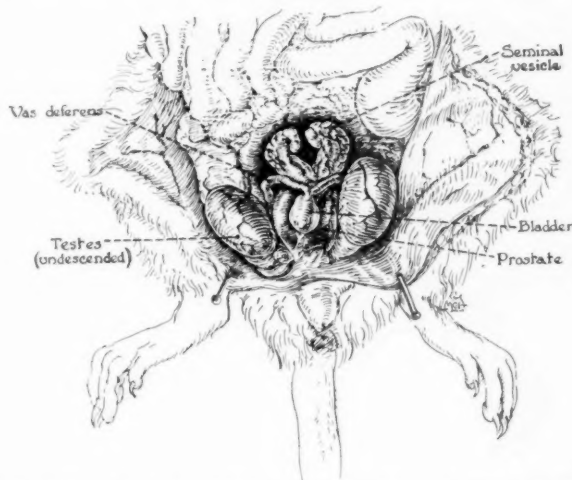


Fig. 8.—Injected male rat, a litter mate, with undescended testis. Positive reaction. Note the marked enlargement of the seminal vesicles, the vas deferens, and prostate.

control animal. Maturity of the entire genital tract is in evidence; however, only the findings of the ovary should be used to decide the pregnancy test (Figs. 4 and 5). On microscopic section the ovary contains numerous large follicles in all stages of maturation. Massive hemorrhages are present in many of the follicles. The marked tendency towards luteinization is evidenced by numerous corpora lutea, the extensive replacement of theca and granulosa cells of many follicles by lutein cells, and the imprisonment of the ova within them, forming atretic follicles.

Immature male rats from 35 to 40 days old and weighing from 40 to 50 grams have proved, in our experience, to be excellent animals for this test. The test depends entirely upon the development and maturity of the secondaries, principally the seminal vesicles and prostate. Due to the size of the test animal the gross examination of the genitalia in situ is sufficient to make the diagnosis. Furthermore, they can tolerate injections of 2 c.c. of urine twice and three times daily, so that five or six injections can be given over a 48-hour period. In our earlier work, when all injections were given subcutaneously, the test took seven or eight days for its completion, thereby not being entirely ideal. Although Aschheim and Zondek cautioned against accidentally entering the peritoneal cavity as being fatal to the animal, Dr. F. L. Adair suggested that we try this method. At present all our injections in males and females are given intraperitoneally. The males can be examined from forty-eight to seventy-two hours after the last injection.

While we have made microscopic sections of many of the male and female tests, this has never been necessary for a diagnosis.

In the male rat one depends entirely on the precocious development of the sexual accessories for a positive pregnancy test. The seminal vesicles are distended and filled with their secretions. The epididymis and Cowper's glands are only slightly hypertrophied. When the test is positive this change in the accessories is striking (Figs. 6, 7, and 8).

There may be some gross enlargement and hyperemia of the testis. On microscopic examination the cells of the seminal vesicles are all columnar in type and distended with secretion.

The patient is instructed to bring a morning specimen of urine in a clean bottle. Catheterized specimens are not necessary, but one must insist upon the first morning concentrated specimen. When not used, the urine can be kept at "ice-box" temperature and heated to body temperature before the injections. No preservative is necessary, but a drop or two of toluol will preserve it for a week or longer. A 2 c.c. Luer syringe with a sterile hypodermic needle may be used for the injections. The rat is held in the palm of the hand, the abdominal wall picked up between the thumb and forefinger, the needle pushed through into the peritoneal cavity, and the contents slowly injected.

Aschheim and Zondek report as high as a 17 per cent mortality with their immature mice. We have had a 3.5 per cent mortality with the use of rats, and their deaths were all due to toxic urines. Of the six specimens of urine which killed the rats, three were from patients with severe hyperemesis gravidarum and two from patients with pyelitis. One can readily understand the cause of the toxicity in these cases. Zondek recently described a method for detoxicating urine before injection, but we have as yet had no opportunity to try this.

TABLE I

GROUP I	GROUP II
Diagnosis confirmed by subsequent examination or findings	Diagnosis could not be confirmed
157*	15

*Since this paper was read we have completed a total of 400 accurately controlled pregnancy tests with this method, using male and female rats as described. The percentage of error has remained less than 2 per cent. This additional work has convinced us that the male rat is somewhat more preferable for the test than the female.

TABLE II. ANALYSIS OF TOTAL GROUP OF CASES

	REACTIONS		ERROR
	+	-	
Pregnancy	104		
Abortions	10		
Ectopic Pregnancies	3		
Menstrual Irregularities	45		
(other than pregnancy)			
Menopause	2		
Fibroids	6		
Postpartum	10		
Other Conditions	3		
	115	2	1.7%
	1	44	
	0	2	
	0	6	
	10	0	
	0	3	1.5%

RESULTS

The large majority of our tests were performed for the purpose of diagnosis, and the accuracy of the result was confirmed by subsequent observation and examination of the patient or at operation. The following tabulations briefly summarize the cases studied and give the percentage of error (Tables I, II, and III).

TABLE III. PREGNANCIES

TO 6 WEEKS	6 TO 12 WEEKS	3 TO 10 MONTHS	ABORTIONS	ECTOPIC	L. M. P. NOT KNOWN	REACTIONS		ERROR
						+	—	
33	15	29	10	3	27	115	2	1.7%

The three cases in which the test was in error are briefly summarized:

1. A patient, age twenty-eight, missed her menstrual period for five or six days, and a pregnancy test on female rats proved to be negative. Three weeks later the test was repeated on male rats and it was positive.
2. A case of known pregnancy gave a negative reaction near term.
3. A patient, age fifty, with a history of irregular bleeding for three months, gave a positive reaction. Subsequent observation proved her to be in the menopause.

The positive test is probably dependent upon living chorionic tissue being in contact with the circulation. Thus it remains positive for seven or eight days postpartum, when it becomes negative (Table IV). Likewise, it will remain positive for the same length of time following fetal death early in pregnancy and near term. In two missed abortions the test proved positive early after the suspected death of the fetus and became negative as the patient was kept under observation; the uterus failed to grow. All of the abortions, threatened or incomplete, gave positive tests. The usefulness of this test to determine retained secundines in incomplete abortions is doubtful during the first week following the abortion. Three unruptured ectopic pregnancies gave positive tests very early in their course and all were removed unruptured at operation.

TABLE IV. POSTPARTUM CASES

Case Number	4th day	5th day	6th day	7th day	8th day	9th day
124	+	+	+	+	—	—
123	+	+	+	+	—	—
25	+	+	+	+	—	—
152	+	+	+	+	—	—
153	+	+	+	+	—	—
159	+	+	+	+	—	—
160	+	+	+	—	—	—
178	+	+	+	—	—	—
179	+	+	+	+	—	—
181	+	+	+	—	—	—

It is in such cases that the pregnancy test gives very useful additional information.

The menstrual irregularities accompanying the menopause and endocrine disturbances offer excellent cases for differential diagnosis. Many a patient can be relieved of her anxiety in four or five days instead of the usual four to six weeks' observation.

Tumors, adnexal or uterine, associated with or without a pregnancy, may offer unusual difficulty in diagnosis, and any laboratory aid is more than welcome.

We have had no cases of hydatidiform mole or chorionepithelioma. In these conditions the concentration of the hormone in the urine is so great that only a fraction of the usual dose is needed to give a positive test. Many of the observers have suggested that every mole should have frequent hormonal tests, and the return of a positive reaction should be regarded with suspicion of the development of a chorionepithelioma.

SUMMARY

1. The biologic pregnancy test of Aschheim and Zondek, based on the principle of demonstrating the sex hormone of the anterior lobe of the pituitary in pregnancy urine, is a valuable addition to our obstetrical diagnosis.

2. The pregnancy test is most accurate in the first two weeks following the missed menstrual period, when bimanual palpation and examination is far too uncertain. It can, therefore, be of great value in the differential diagnosis of pathologic conditions simulating very early pregnancy.

3. The use of immature male and female rats has made the test more applicable to routine laboratory use.

4. Gross examination of the genitalia is sufficient to make an accurate diagnosis in more than 98 per cent of the cases.

5. The intraperitoneal injection of large doses of pregnancy urine in the rats has shortened the time necessary for the test so that one can usually await its outcome, except in emergencies.

DIATHERMY IN THE TREATMENT OF GONOCOCCUS CERVICITIS AND URETHRITIS

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DEFINITELY favorable results in the treatment of gonococcus infections of the cervix and urethra by diathermy, as reported by Corbus and O'Connor,¹ Walther and Peacock,² and Cumberbatch and Robinson,³ stimulated us to test the method. Thirty-eight unselected patients were treated by this procedure, and the results obtained form the basis for this report.

TECHNIC

A Wappler diathermy machine was used, with a cervical thermophore as the active electrode in both cervix and urethra, while the passive electrode was placed alternately over the abdomen and the sacrum. The number of applications varied from one to eight, but averaged six in both the urethra and the cervix, while the duration of the treatments varied from ten minutes to one hour, with the majority of twenty minutes' duration or longer. In some instances, treatments were given on succeeding days, and in others only on alternate days. In a few, the applications were alternated between the urethra and the cervix, while again the cervical series was completed to be followed by the urethral treatments, or vice versa. During the course of the diathermy treatments, no other therapy was employed. Temperatures were recorded from the thermometer on the inside of the active electrode. An attempt was made to maintain a temperature of 115° F. for the duration of the treatment, but in many instances, especially in the urethra, such a temperature could not be tolerated.

Observations were confined to those patients in whom gonococci were demonstrable microscopically in the secretions, and the effect of treatment was evaluated by the presence or absence of the organisms in three consecutive weekly smears (one of which must have followed a menstrual period), as well as by changes in the clinical signs, such as the amount of discharge and the degree of irritation of the vaginal mucosa. Of the 38 patients treated, 20 showed gonococci in the cervix and 31 had organisms in the urethra.

RESULTS

The results of the diathermy treatments upon the microscopic and clinical pictures in these 38 cases are tabulated in Table I.

TABLE I. RESULTS OF DIATHERMY TREATMENTS

LOCATION OF INFECTION	TOTAL CASES	SMEARS AFTER DIATHERMY		CLINICAL SIGNS		
		NEGATIVE	POSITIVE	IMPROVED	UNIMPROVED	WORSE
Cervix	20	14 (70%)	6 (30%)	4	7	3
Urethra	31	14 (45%)		2	4	0
			17 (55%)	8	5	1
				0	16	1

It is evident that diathermy produced satisfactory clinical and laboratory results in roughly one-quarter of these cases; in 4 of the 20 with cervical infection (20 per cent), and in 8 of 31 with urethral infection (26 per cent).

Closer analysis revealed that neither the number of treatments, the duration of each seance, nor the temperature maintained in the treated area had any direct effect upon the result obtained.

TABLE II. THE EFFECT OF TEMPERATURE AND DURATION OF TREATMENTS UPON THE MICROSCOPIC AND CLINICAL RESULTS

SMEARS STILL POSITIVE AFTER DIATHERMY			
<i>Cervical Infection</i>			
	IMPROVED	CLINICAL SIGNS UNIMPROVED	WORSE
Average temperature	115.5	114.5
Average duration (minutes)	57	45
<i>Urethral Infection</i>			
Average temperature	108	106
Average duration (minutes)	27	60
SMEARS NEGATIVE AFTER DIATHERMY			
<i>Cervical Infection</i>			
	IMPROVED	CLINICAL SIGNS UNIMPROVED	WORSE
Average temperature	113.5	113.5	112.5
Average duration (minutes)	52	29	27
<i>Urethral Infection</i>			
Average temperature	107.5	108	106
Average duration (minutes)	31	27	40

The 4 patients who had cervical gonorrhea and who apparently were cured by diathermy had treatments averaging fifty-two minutes at 113.5° F., while the successful urethral cases were treated for an average of thirty-one minutes at a temperature of 107.5° F.

The milliamperage employed has not been mentioned in the discussion, as Bordier⁴ has called attention to the fact that the flow of current is not an accurate index of the temperature, and our findings support this contention.

TABLE III. DISSEMINATION OF HEAT THROUGH PELVIC ORGANS

POSITION OF THE PASSIVE ELECTRODE	ACTIVE ELECTRODE IN THE CERVIX (DEGREES, FAHRENHEIT)		
	CERVIX	URETHRA	RECTUM
Abdomen	115	103.5	101
Sacrum	115	102	103
	ACTIVE ELECTRODE IN THE URETHRA		
	URETHRA	CERVIX	RECTUM
Abdomen	108	101	100
Sacrum	108	101	102

TEMPERATURES IN NEIGHBORING STRUCTURES

Observations on the temperature developed in surrounding structures were made in a number of patients and revealed marked variations, apparently no constant relationship being maintained between simultaneously taken temperatures in the urethra, cervix and rectum. Table III presents average readings and serves to give some idea of the dissemination of heat throughout the pelvis.

REACTIONS

Of the various reactions, which occurred during the course of the treatments, lower abdominal pain and cramps were the most frequent, being noted in seventeen instances. Cervical treatments precipitated uterine bleeding in seven patients, one of whom, a girl of twenty years, had her second catamenia since puberty following diathermy to the cervix. Discomfort in the urethra was a rather constant accompaniment of the urethral treatments, while in six cases severe pain in the urethra occurred even at the lower temperatures, and in four patients there was a constant desire to void, associated with some incontinence. Severe backache occurred in five individuals, nausea in four, and excessive pain in the vagina in one. Small necrotic areas appeared around the urethral orifice in two instances, and around the cervical os once. These lesions healed quickly after the diathermy was discontinued. There were no serious complications, such as acute salpingitis or pelvic peritonitis.

DURATION OF HOSPITALIZATION

All patients were confined to the hospital. The arbitrary criteria for dismissal as noninfectious demand three consecutive weekly negative smears, one of which must be taken after a menstrual period, together with disappearance of clinical signs of infection. Those patients whose secretions still contained gonococci, or in whom redness and discharge were still present after completion of the course of diathermy, were treated further by the usual procedures, antiseptics, douches, and cautery, until the criteria for noninfectiousness were satisfied. Since duration of hospitalization is of economic importance, we were interested to learn whether by the use of diathermy, we had shortened the hospital stay. These figures are shown in Table IV together with the findings in fifty similar patients treated by methods other than diathermy.

TABLE IV. DURATION OF HOSPITALIZATION

38 patients treated with diathermy	78 days (11 weeks)
50 patients treated by other procedures	56 days (8 weeks)

The shortest stay in the first group was twenty-eight days, which, incidentally, is the shortest possible under our standards for dismissal, while the longest was 216 days (31 weeks), in an extremely resistant case of urethritis. It is apparent that diathermy did not shorten the period of hospitalization, but, on the contrary, seemed to lengthen it by three weeks, which is roughly the time utilized by the treatments.

DISCUSSION

Van Leeuwen⁵ has called attention to the variations in temperature at which different workers have observed survival of the gonococcus, and it is even more uncertain at what temperature the organisms are killed in the presence of living tissue cells, as, for example, in the depths of the cervical glands. Provided the gonococci are killed quickly at a temperature of 113° F., and that it is possible safely to maintain a temperature of from 115 to 117° for considerable periods without destroying tissue cells, diathermy should be an ideal method of treating gonococcal infections of the cervix and urethra. Under such conditions, a single application above 113° F. should suffice to cure the patient. Our experience would indicate that the heat of diathermy does not penetrate to the organisms in the depths of the cervix and urethra in sufficient intensity to kill the gonococcus (the temperatures recorded are for the inner surfaces of the electrodes), or that these organisms in living tissues are not killed by heat as quickly as in the test tube.

Our results seem to have been better when moderate temperatures were employed, suggesting that the benefit noted in certain cases may have been due to an increased local vascularity (uterine bleeding was recorded in 35 per cent of the cervical cases), rather than to actual thermal destruction of the gonococci.

SUMMARY

Satisfactory clinical and laboratory results were obtained in 20 per cent of the series of patients with gonococcus cervicitis and in 26 per cent of those with gonorrheal urethritis by diathermy treatments alone. No serious complications followed the applications. The average hospital stay of the group was three weeks longer than that of a similar group of patients treated by other procedures.

Diathermy to the cervix and urethra may be looked upon as an adjuvant in the treatment of gonococcus infections of these structures, but not as a positive cure even when temperatures of 115 to 116° F. may be maintained. We believe that equally good results may be obtained by the simpler methods of treatment more commonly employed, and are inclined to the opinion that when diathermy gives good results they are due to the increased vascularity induced rather than to actual thermal destruction of the gonococci.

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TUBERCULOUS ENDOMETRITIS. REPORT OF CASES

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TUBERCULOSIS of the uterine body, commonly held to occur infrequently, is of frequent occurrence. Norris holds that with the exception of the tubes, the endometrium is the most frequently involved, in genital tuberculosis. The percentage of tuberculous salpingitis, varies from 5.5 per cent to 24.6 per cent of all salpingitis, according to various authors. In a series of 22 cases of salpingitis which came to operation during the last year, two, which we are presenting, were tuberculous and each was accompanied by tuberculous endometritis.

Clifford White finds the tubes involved in 85 per cent of all genital tuberculosis, the uterus involved in 53 per cent of all cases of genital tuberculosis, and the uterine body including the endometrium involved in 85 per cent of all uterine tuberculosis.

Though primary endometrial tuberculosis is said to occur, Norris found not a single instance of endometrial tuberculosis without an accompanying tuberculous salpingitis.

Neither of our two patients were suspected of being tuberculous, the first was operated upon for a fibromyoma uteri and the second was thought to have a chronic nonspecific salpingitis.

CASE REPORTS

Mrs. A. S., aged forty, was admitted May 12, 1930, complaining of abdominal pain. Menses began at eleven, every thirty days and of five days' duration with no dysmenorrhea. Her last period occurred on April 27, 1930. She has been married for twenty-eight years, but was never pregnant.

She complained of "dry pleurisy" of her right chest sixteen years ago lasting five weeks. At about the same time she was operated upon for rectal fissures.

About eight years ago she began to complain of burning pain in the left side of the abdomen, lasting off and on for a few years, treated by medications and finally disappearing. For two months prior to admission she complained of pain in her right lower quadrant, associated at one time with backaches. She also complains of a drawing pain in both inguinal regions.

On physical examination, there was an irregular nodular mass suprapubically. Her vaginal outlet was nulliparous. The cervix was held high behind the symphysis. The uterus corresponded in size to that of three months' gestation. The adnexa were not palpated. Her urinary and blood pictures were negative. A chest plate revealed no pleural changes. A preoperative diagnosis of "fibromyoma uteri" was made.

A laparotomy was performed the day after admission. The uterus was found enlarged and nodular. Some of the nodules were intraligamentous. The right adnexa were adherent to the upper portion of the sigmoid. The adhesions were separated, and a supra-cervical hysterectomy and left salpingo-oophorectomy were performed. Her postoperative course was uneventful. She was discharged in excellent condition on May 28, 1930, thirteen days postoperatively. Her physical condition has remained good following her discharge.

Grossly the uterus was twice its normal size and nodular, one nodule hanging freely in the uterus cavity by a narrow short pedicle.

The left tube was normal in size and patent. The fimbriated end was adherent to the ovary. Several small dewdrop cysts were present on the posterior tubal surface. The rest of the serosa was smooth. The mucosa was rough, shaggy, felt gritty and presented numerous white pinpoint projections above this surface.

The left ovary was cystic, and slightly larger than normal. On section many atretic follicular cysts and a corpus luteum were present.

Microscopically: 1. Uterus: The endometrial lining and glands were normal. Nests of normal glands were present deep in the wall. In the fundal portion of the endometrium many of the glands were lying parallel to the surface and somewhat atrophic. In this region a large tubercle was present. Separated from this tubercle by several uterine glands was a smaller similar tubercle.

2. Fimbriated end of tube: The plicae were swollen, fused. Adjoining the capillaries, in the fused plicae, was a group of numerous tubercles, surrounded by a heavy small round cell mantle. In the vicinity of the tubercles and in all the plicae were numerous giant cells, some engulfing calcified laminated particles. Some of these were in the center of one of the tubercles described above. The plicae themselves were heavily infiltrated with small round cells. The wall of the tube was not involved in any of the above described pathology.

3. Cystic portion of ovary and attached tube: The greater portion was cellular connective tissue and contained several "corpora albicantia." Areas of vessel congestion with polymorphonuclear infiltration were present at the periphery. At the lower pole of the section was a corpus luteum. Several atretic follicles were present in the center of the section surrounded by a small round cell infiltration. At the upper pole were many calcified areas.

The pathologic diagnosis was tuberculous salpingitis, both recent miliary and chronic miliary (healed, calcified), tuberculous endometritis, adenomyoma uteri, and multiple fibroids.

Case 2.—Mrs. M. Y. was admitted Nov. 15, 1929, complaining of pain in her left lower quadrant. Her menses began at thirteen, every thirty days for three days without dysmenorrhea. Her last menstrual period was Nov. 3, 1930. She was married seventeen years, grava v, para iv.

Her third delivery, ten years ago was followed by puerperal sepsis, leaving her with monthly recurring attacks of pain in the left lower quadrant. The pain was sticking and localized. Nine months ago she developed pain in the right upper quadrant, the pain radiating to the back and right shoulder and associated with jaundice and epigastric distress. Five days before admission she was seized with this pain, ran a temperature of 101°, and had chills the following day. On admission her temperature was still 101°.

Abdominal tenderness was present in both lower quadrants, with a sense of resistance over the left lower abdomen. Under anesthesia a definite mass was palpated a little above the left Poupart ligament, quite indurated. In the left fornix was a mass running obliquely from the left cornus of the uterus, about 10 cm. long, and about 6 cm. wide. There seemed to be a cleft between the mass and the fundus of the uterus. The mass was firmly fixed and did not move with the uterus. The right fornix was empty. She had 12,400 W.B.C. and 84 per cent polymorphonuclears and a twenty-five minute sedimentation time. A diagnosis of chronic adnexitis was made. A chest plate was negative for signs of tuberculous infection.

On Nov. 23, 1930, a laparotomy was performed. Marked adhesions of the bowels and omentum to the parietal peritoneum and to the left tube and uterus were present. The left tube was chronically inflamed and the ovary was cystic. The right tube was grossly normal and the right ovary somewhat cystic. The

peritoneum appeared chronically inflamed. The adhesions were carefully separated, but some pus was spilled into the peritoneal cavity. (Culture of this pus was sterile.) The left tube and ovary were excised and the culdesac and left lower quadrant drained. The drains were removed on the fifth day postoperatively. The wound healed nicely. She was discharged as cured on Dec. 18, 1930.

The tube measured 5 by 3 by 2 cm., the serosa irregular but glistening and contained an irregularly small opening which led into a blind cavity in the tube, 1 cm. deep, the walls of which were ragged, but glistening and varied from grayish yellow to deep red. The wall of the tube was 3 mm. thick. Small cysts containing clear fluid were present in the upper and lower tube wall. The tubal mucosa was pink and velvety.

Very intimately attached to the tube was the ovary slightly larger than normal, and cystic throughout. On cut section, several corpora hemorrhagica, and several retention cysts were present.

The tubal mucosa was completely replaced by a very dense small round cellular stroma in which were found numerous tubercles. A few discrete giant cells and areas of endothelial cells without giant cells were also present.

Sections through the distal end of the tube showed large masses of polynuclear leucocytes and nuclear fragments on the mucosal surface.

Sections through the ovary revealed a few large retention cysts. The pathologic diagnosis was tuberculous salpingitis with secondary infection and abscess formation, and retention cysts of ovary.

After her discharge, the patient underwent the usual systemic treatment for tuberculosis. Her wound would open, discharge watery pus and then close in a few days. About a month before her second admission she complained of severe pain in her left lower quadrant, the lower angle of the wound was opened with the evacuation of about six ounces of thick greenish yellow pus, sinus opening remaining patent. Her physical condition was excellent, she had not lost weight nor had any symptoms of a systemic infection.

She was readmitted on Sept. 16, 1930. The old scar, including the sinus opening, was excised down to the peritoneum. An egg-sized mass beneath the peritoneum proved to be the left cornua of the uterus, the stump of the left tube and adherent small bowel. A probe passed through the fistulous opening in the peritoneum, led down for $\frac{1}{2}$ inch into the bowel. The bowel was separated and the fistulous opening into it closed. The right tube and ovary were buried in a mass of caseous adhesions. A supracervical hysterectomy and a right salpingo-oophorectomy were performed. She was discharged on Oct. 13, 1930 to a convalescent home, in excellent physical condition with a small discharging sinus.

Grossly, the mass of skin and fat was perforated by fistulas whose surface was lined by a glistening pinkish layer containing some scattered small dewdrop-like nodules on its surface.

The uterus appeared normal. The right tube was adherent to the right ovary by caseous adhesions.

Sections of the sinus were composed of cellular fibrous tissue in which were scattered several large tubercles with caseating centers. Degenerated striated muscle bundles adjoined the tubercles. A perivascular small round cell infiltration was present around the smaller vessels.

The endometrium contained numerous glands in the resting stage, a few parallel to the surface and atrophic. In the deeper portion of the endometrium among the glands, were a group of discrete small tubercles with caseating centers and circumferential grouping of small round cells. The stromal cells surrounding these tubercles appeared hyperplastic: a few resembled fibroblasts.

Section of the ovary showed cellular connective tissues containing corpora albicantia. Toward one pole of the section were several areas of homogeneous eosinophilic debris bordered toward one side by small round cells and plasma cells.

The pathologic diagnosis was tuberculous sinus, tuberculous peritonitis, tuberculous endometritis and tuberculous salpingitis.

In retrospect, both cases gave symptoms suggestive of tuberculosis, a story of years of abdominal pain, suggesting a low-grade peritonitis which in the absence of gonorrheal history or symptoms, should have been regarded as tuberculous. The first patient in addition had a definite history of dry pleurisy and rectal fissures.

The tuberculous endometritis in each case was early and the tubercles were present only in fundal mucosa surrounding the tubal mouths. This is suggestive of the view held by Norris that the spread from the tubes to the endometrium is by direct continuity through the opening of the tube into the uterus.

Because of early uterine involvement, a complete hysterectomy is advisable as soon as the diagnosis of tuberculous salpingitis is made to avoid a stormy postoperative course. This is brought out by the treatment and subsequent story of our two cases. The first patient was hysterectomized and made an uneventful recovery, without any future complication. The second patient presented bowel involvement and sinus formation after her first operation, and still has a discharging sinus two months after her second operation.

ENDOMETROID HETEROTOPIAS OF THE UMBILICUS

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A COMPREHENSIVE understanding of the embryology and histogenesis of the entoderm and mesoderm, in the embryo, is necessary in order to evaluate and classify the various types of cysts and heterotopias which may occur in the anterior abdominal wall. Especially is this necessary to clarify the possible source of the so-called endometriomas of the umbilicus.

The umbilical cord contains besides its arteries and veins, the allantois and yolk stalk. Normally the yolk stalk, which is in direct tubular connection with the gut track and lined by entoderm, atrophies at the sixth week; but any portion of it may persist, either within the abdominal cavity or in its passage through the abdominal wall. Roques⁴⁷ points out that portions of the vitelline duct may persist at the umbilicus, but the epithelium does not possess the function of menstruation, nor are these portions surrounded by endometrial stroma, and any portion of this tract may show heterotopic differentiation.

The allantois in the human embryo is only rudimentary and has no excretory function as in the lower scale of vertebrates; but does push out into the umbilical cord and remain patent until the second month when it normally becomes obliterated not simultaneously throughout its length but at irregular intervals so that small areas remain in which the lumen still persists. These areas may disappear later or give rise to cavities which later may form cysts. The lining of the urachal tube is composed of one or more layers of transitional epithelium which is covered by a circular and longitudinal coat of nonstriated muscle which in turn is surrounded by connective tissue. Cysts so formed often connect with the bladder and contain urine, their most frequent complication being intracystic hemorrhage. In practically all

cases cysts formed from the urachal stalk are lined by stratified epithelium and have a definite remnant of the stalk attachment to the bladder and thus are differentiated from the other cysts arising in the anterior abdominal wall.

Keibel, Lewis and Thyng describe diverticuli occurring normally in the entoderm tract of the embryo; and these because of some abnormal stimuli, according to Nicholson,^{43, 44} may form permanent diverticuli or cysts occupying any part of the gut or its periphery. The lining of these cysts may be stratified, cuboidal, columnar, flat, or any other variation. This is accounted for by Evans⁴⁵ as being due either to intracystic pressure, inflammatory changes, or error in differentiation of the lining cell. According to Begg,¹ there can be no doubt that cysts whose wall reproduces completely or incompletely the structure of the gut, whether discovered in the gut, attached to the gut, or remote from the gut, must have been derived from the gut. Meckel called only those diverticuli true diverticuli which were composed of all the walls of the entoderm canal and said they all arose from vitellointestinal duct anomalies; but since then cases have been recorded having a Meckel's diverticulum and also other diverticuli and heterotopias.

Nicholson^{43, 44} says heterotopias are due to anomalies of cell differentiation due to environment of the cells; if this is normal, differentiation is normal; if the cell is exposed to abnormal influences, its differentiation will be abnormal.

Gastric gland heterotopias at the umbilicus generally take the form of a polyp with or without a central sinus; resulting from heterotopic differentiation of an unobliterated vitelline duct. Taylor³³ says it is this type of heterotopia over which discussion of adenoma character is raised. These were first called intestinal heterotopias by Tillmanns⁵⁴ in 1882, and Muller⁴² in 1921 discussed them at length. Stone⁵⁵ in 1923 reported thirty-eight cases from the literature, four of which came from gastric mucosa and the remainder from normal intestinal epithelium. Typical umbilical polypi of intestinal origin secrete intestinal juices and tend to reproduce the tissue of their origin.

The other structures of importance in the embryo as to possible sources of the so-called endometriomas of the abdominal wall are the mesoderm segments from which are derived the urogenital system and the peritoneum. Von Recklinghausen⁵⁶ in 1895 advanced the theory of the origin of endometriomas from remnants of the wolffian ducts. Ivanoff⁵⁷ in 1898 believed its origin to be from a metaplasia of the peritoneal mesothelium, which view has been recently revived by R. Meyer^{2, 3, 30, 40, 57} and Lauche.⁵⁵ Walz⁵⁷ describes the coelomic basal cell as bi-potent, that is, it is capable of forming two types of cells, serous epithelial cells and endometrial cells which are unipotent and differentiated. These two types of cells have a common origin, but develop along two divergent lines of differentiation according to the principles of physiologic specialization and adaptation to environment and function. It is in the highest degree unlikely that a serosal cell could by metaplasia become converted into an endometrial cell and explain the occurrence of uterine gland cells in the peritoneum. The only logical explanation is that such endometrial cells have arisen from basal coelomic epithelial cells, occurring scattered in the serous epithelium, which have remained during post-fetal life at the primitive stage and possessing the primary function of reproduction. Krompecher⁵⁸ has insisted that the reproductive capacity in any type of epithelium is greatest in the basal layer as it corresponds most nearly to the embryonic cell with its capacity for proliferation.

Cullen² in 1916 advanced his theory of embryonic inclusions of Mullerian duct tissue and to Cullen probably belongs the credit for first really studying adenomyomas of the umbilicus although Goddard has reported two cases a few years earlier. Halban^{18, 38, 57} in 1924 considered that the endometrial particles entered the lymphatics of the uterus and were thus carried to various situations. R. Meyer⁴⁰ criticizes this view in that endometrial cells have never been found in the lymphatics, and also

that a general endometriosis would be expected in a case of internal endometriosis. Mestitz²⁸ on the other hand, states that endometrial glands have frequently been found lying deeply within the myometrium, close to the lymph spaces which they have invaginated; also endometrial inclusions have been found in the regional lymph glands, although never found inside the lymph vessels. Recently Sampson^{48, 49, 50} has suggested still another view of implantation endometriosis in which implantations arise from fragments of endometrial tissue which have escaped into the peritoneal cavity during the menstrual period due to a back flow through the fallopian tubes and from the tubes themselves, and from endometrial growths upon the surrounding peritoneum. Extraperitoneal endometrial tissue arises from metastasis, from the mucosa of the uterus or from endometrioma of the peritoneum, by way of the venous or lymph circulation and from heterotopic endometrial tissue in the groin, vulva, umbilicus, and possibly in the vagina and pelvis. Cullen⁵⁰ more recently has stated that adenomyomas must be looked upon as embryonic inclusions especially when occurring in the round ligament and umbilicus: but some ovarian, some rectovaginal septum growths, some intestinal adenomyomas may owe their origin to transplanted uterine tissue; while adenomyomas developing in abdominal scars, after operations on the uterus or tubes are undoubtedly due to transplants and not to embryonic inclusions.

Jacobson²⁵ in 1922 was probably one of the first to attempt implantation, of uterine mucosa, in animals, endeavoring to prove or disprove the theory of Sampson. At this time autotransplantations of endometrial tissue were made into rabbits with the production of cystadenoma-like growths similar to cystadenoma of the ovaries. In later experiments, Jacobson^{24, 25} reinforced these findings by further intraperitoneal autotransplantations of endometrial tissue in rabbits and monkeys. In these studies he came to the conclusions that transplantations nearly always occurred on the pelvic peritoneum and not on the abdominal wall or mesentery. Castration at the time of transplantation did not prevent growth but the cysts formed were smaller and thinner walled.

Heim²¹ in a series of experiments on apes, divided them into three groups; in the first group, implants were made into the peritoneum of pieces of the animal's own decidua menstrualis; in the second, a fistulous opening was made between the uterus and peritoneal cavity during menstruation; in the third group, fresh human menstrual fragments were implanted into the peritoneum and ovarian epithelium, with simultaneous injection of human ovarian extract. These animals were all killed from forty to sixty days following these experiments and no growths were obtained; only inflammatory foci remained as evidences of the implantations.

Dossena⁷ in a series of experiments, on white rabbits and mice, removed the uterine mucosa, minced it and scattered it in the abdominal cavity, obtaining cystic growths of this tissue without scarification of the peritoneum. These cystic cavities were lined with columnar epithelium and were surrounded by a vascular connective tissue stroma and nonstriated muscle fibers; this evidence he believed to give support to the theory of Sampson. Katz and Szenes³⁰ transplanted pieces of endometrium into the peritoneal cavity of rabbits in some before and in some after castration. The transplanted tissue grew in those not castrated but did not grow in the castrated animals. From this they concluded that endometrial implants were possible but required ovarian hormone substance for their growth. Walz²⁷ and Heim,²⁹ on the other hand, say it is only the basal cells of the uterine glands which are productive of new cells and the cells shed during menstruation do not include these basal cells of the gland and therefore cannot grow and multiply. From this work with *in vivo* experiments it would seem that uterine tissue containing the basal layers of the glands will grow and multiply with implantation in the presence of ovarian hormone, but menstrual blood which does not contain the basal layer of the glands will not grow and multiply.

This class of tumors occurs only in women usually between the ages of 35 and 45;

they are small, reaching their full size within a course of a few months. At the menstrual periods, the tumor swells, sometimes becomes painful and may discharge a brownish bloody material. They are often governed by the same laws as uterine mucosa in its reaction to menstruation, pregnancy and the menopause. The overlying skin is usually intact, and often pigmented in those of the umbilicus, and lying just beneath the skin are one or more brownish blue cysts, which may rupture and discharge a material resembling old blood. Section of the tumor nodules shows these cysts to vary in size and shape, some containing old blood and separated from each other by glistening bands of fibrous tissue in which there may be fresh hemorrhage or old blood pigment. Microscopic examination shows the cysts to be dilated, irregular, round or oval glands arranged singly or in groups and lined by columnar or flattened epithelium; containing old blood and cellular detritus. These nests of glands are immediately surrounded by a loose cellular connective tissue set in a stroma of dense fibrous tissue interspersed with bundles of nonstriated muscle fibers, giving the suggestion of endometrial tissue.

Cullen² in 1916 reviewed all reported cases of adenomyomas of the umbilicus, deciding that only nine cases were authentic which included one case of his own. This excluded four cases reported by Wullstein, Giannettosia, van Noorden and Mentz. Köhler²¹ in 1927 reported what he claimed was the thirty-second case on record.

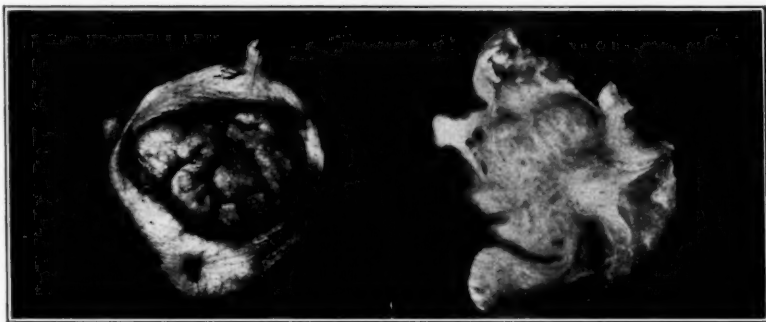


Fig. 1.—Gross specimen after removal.

Enzer¹⁰ in 1930 brought the total number of cases reported including his own case up to a total of forty-one. Since this recent article, I have been unable to find any additional cases, hence, with my own case now making a total of forty-two cases.

Suffice it is that these tumors are comparatively rare, and for that reason and because of their great interest, I wish to present my case as an addition to the preceding work.

CASE REPORT

A woman, forty years of age, came to the hospital complaining of an umbilical tumor which had been present for eleven years. She was married and had one child eleven years of age, following which pregnancy she had noticed a swelling in the navel, but it had caused no trouble until three years ago when it began to enlarge rapidly and cause pain at her menstrual periods, the enlargement and pain subsiding between periods. No discharge had occurred at the menstrual periods.

On examination a papillomatous mass about the size of a hickory nut and covered with a somewhat thickened intact skin was found attached to the umbilicus. This was excised, the incision extending through the peritoneum, so that the adjacent peritoneal surface was removed with the tumor. Section showed a papillomatous tumor mass 3 by 1.5 cm.; covered with a thick layer of squamous epithelium, in the center of which was a spongy tissue with numerous follicle-like spaces, varying in size up to 1 mm. in diameter, many of which contained hemorrhagic material and old

blood. A fibrous tissue core extended down meeting a conical dimple of the peritoneal tissue. On histologic examination the squamous epithelium was intact and normal, scattered throughout the underlying stroma of connective tissue and smooth muscle fibers were cystic spaces with flat epithelial lining and oval, round or irregular dilated glands, with columnar epithelium, occurring singly or in groups, and set in a characteristic fine cellular connective tissue stroma, giving the glands and stroma the appearance of uterine mucosa. Cellular detritus and blood pigment was present here and there in the lumen of the glands and in the stroma. The peritoneal surface was of considerable interest at its point of dimpling into the above tissue. The peritoneal

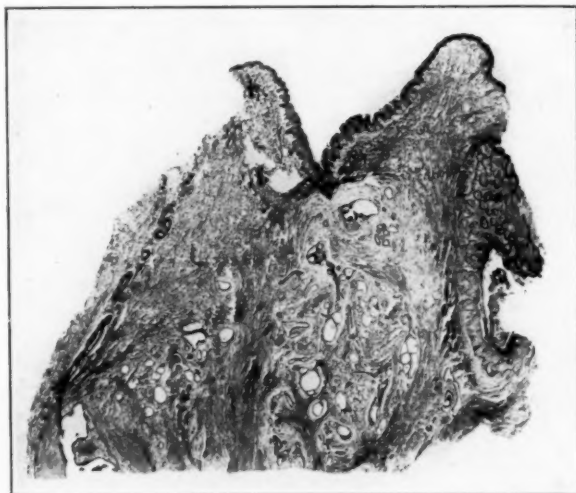


Fig. 2.—Microphotograph, showing numerous glandular and cyst spaces under the squamous epithelium.

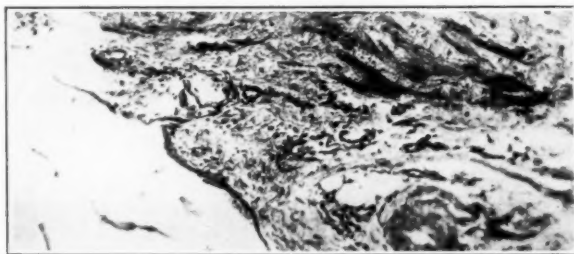


Fig. 3.—Microphotograph, showing the hyperplasia of the underlying peritoneum.

cells were hyperplastic, ranging from euboidal to columnar in structure. At the apex of the dimple the peritoneal cells become flattened out extending into the surrounding tissue and giving origin to a gland-like structure; the walls of which were formed in part by flattened epithelium and in part by columnar cells identical with the hyperplastic cells of the peritoneum. The surrounding tissue was scanty, being composed of a few small stroma appearing cells. Several other small gland structures were present nearby but no definite connection could be seen with the peritoneum, although formed by identical appearing cells.

COMMENT

Thus it is seen that a tumor occurring in women which enlarges and often discharges bloody material at menstrual periods, and which shows the structure of

uterine mucosa with its typical glands and characteristic stroma, and further by the formation of cyst spaces filled with old blood, can well be classed as an adenomyoma of endometrial origin.

The case presented parallels the case described by Enzer¹⁰ in that it gives a histologic suggestion of its possible origin from the peritoneal cells by a process of metaplasia.

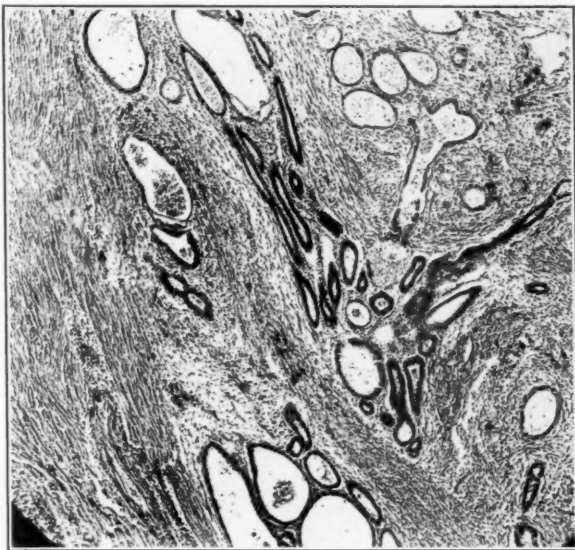


Fig. 4.—Microphotograph, showing the cystic and glandular structures surrounded by fine stroma cells, connective tissue and smooth muscle. Several of the glands are filled with red blood cells and cellular debris.

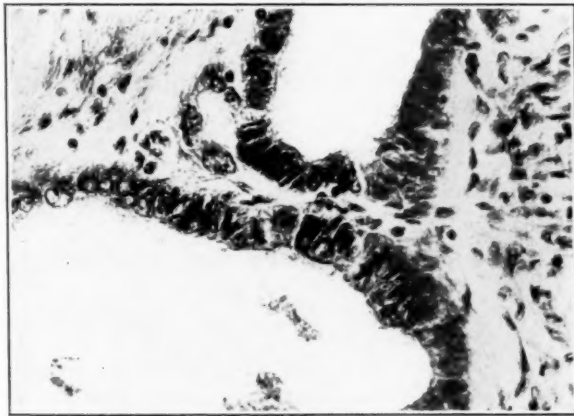


Fig. 5.—Microphotograph, showing the columnar epithelial formation of glands, surrounded by a loose endometroid stroma.

The evidence however is in favor of the origin of this type of endometrioma as arising from the primitive basal coelomic epithelial cells, which may remain in post-fetal life scattered in the serous epithelium and possessing the primary function of reproduction.

Heterotopias arising from remnants of the entoderm tract in the umbilicus do occur but do not give the clinical and pathologic picture of attempted menstruation as do the endometriomas.

Cysts of the urachus are not to be confused with this group of heterotopias, even though they may contain old blood and cellular debris. Urachal cysts are practically always lined by stratified epithelium and are usually connected to the bladder by a definite remnant of the allantoic stalk.

Metastasis by way of the venous or lymph systems has never been definitely proved.

The implantation theory by menstrual reflux seems highly improbable and without conclusive evidence.

If endometrium can be transplanted it is hardly likely that smooth muscle will be carried with it. Meyer, Nicholson and others have expressed the opinion that the smooth muscle fibers may be derived from the local tissue resulting from a metaplasia of the surrounding connective tissue. This has never been proved, however, not even in the presence of endometrial glands. The probability of implantation of endometrial gland cells alone with the derivation of the stroma and smooth muscle cells from another source appears very unlikely as it would be much more simple to have a unicentric origin for all components of the tumor.

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DYSTOCIA DUE TO CONTRACTION RINGS OF THE LOWER UTERINE SEGMENT, WITH A REPORT OF THREE CASES*

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BECAUSE of the relative frequency with which we, in our experience at The Brooklyn Hospital, have encountered contraction rings of the lower uterine segment as a cause of dystocia and the rarity of its mention and description in the literature, it was thought that a brief description of three cases in which they occurred might be of interest. While such a condition is met with in anterior positions only with the greatest rarity, that they do occur is well illustrated by the first case. In an occasional labor where the breech is presenting, we have been surprised to find it entering as a factor of difficulty. By far the greatest proportion of cases in which this troublesome complication has developed has been those in which the vertex has presented with the occiput posterior.

A probable explanation for this frequency with which we encounter these contraction rings in contrast to their rare occurrence in the experience of others, lies in the method advocated and practiced by the late Dr. Ralph Pomeroy of dealing with persistent occipitoposterior positions. In this method, the hand is introduced through the cervix late in the first stage or occasionally early in the second stage of labor, the vertex is grasped and pushed up above the pelvic inlet and rotated through an arc of 180 degrees to the anterior position of the same oblique. Under ordinary circumstances this maneuver is accomplished with relative ease, but in the presence of a contraction ring a firm band of the lower uterine segment is found to be clamped tightly around the baby's neck and the fingers are passed under the lower edge of this ring only with extreme difficulty and the vertex cannot be pushed upward until this band has been relaxed by very deep anesthesia. This intrauterine manipulation after a greatly prolonged first stage, has many times definitely revealed the presence of a condition which otherwise might only be surmised.

CASE 1.—Mrs. B. W., aged twenty-six, para i, was admitted to The Brooklyn Hospital June 2, 1926 after an uncomplicated pregnancy. Pains had begun five hours previously, and the membranes had ruptured spontaneously at home two hours previously. Admission examination noted the vertex in the brim of the pelvis with a thick cervix one finger dilated, pains every three minutes with strong contractions.

*Read before the Brooklyn Gynecological Society, May 1, 1931.

Morphine gr. $\frac{1}{8}$ and scopolamine gr. $\frac{1}{200}$ were given hypodermically two and one-half hours after admission and repeated two and one-half hours later. The first real progress was noted almost eight hours after admission and eleven hours after the onset of labor. The vertex had made some descent, though not yet engaged, and the cervix was soft and open the size of a twenty-five cent piece. Morphine gr. $\frac{1}{8}$, scopolamine gr. $\frac{1}{200}$ were again given and later repeated. Hard labor continued for twelve hours more during which time the vertex descended a little, the cervix thinning, flattening and dilating to a diameter of three inches. Rectal ether was attempted, but not retained. Twenty-four hours after labor began, vaginal examination under gas-oxygen anesthesia with the entire hand in the vagina showed the vertex in the L.O.A. position. No disproportion between the fetal head and birth canal could be made out. Ether in oil with quinine was given by rectum and retained. Six hours after this vaginal examination another was done but the vertex had not descended much more. Cervix thinner, only a rim left, anteriorly and on the sides. A definite abdominal ridge was felt about two inches above the symphysis. This was at 5 A.M. of the day following admission. At 7:30 A.M. after thirty-four hours of labor, she was fully dilated, but the vertex remained high. Ether in oil was again given by rectum. At 10:30 A.M., three hours after full dilatation had been effected, vaginal examination showed the vertex to have descended, but not yet in mid pelvis. Frequent, hard contractions continued. Sodium bromide and chloral hydrate were given by rectum. Seven hours after the beginning of the second stage, the vertex was in mid pelvis, almost at the level of the spines and showing a tendency to come down with pains. Gas-oxygen analgesia was begun because of the severity of the pains. At 3:30 P.M. the vertex had reached the level of the spines and at 4:30 the sphincter ani was dilated. At 6 P.M. there had been no progress for three hours. A note was made that during a pain the vertex would move down and then slide back, as though pulled upward when the contraction relaxed. Forceps extraction was now decided upon. A hard pull was necessary to start the vertex, but thereafter the pull was an easy one. A right lateral episiotomy was done and the baby, weighing 8 pounds 8 ounces, delivered at 6:20 P.M., making the duration of labor forty-six hours, that of the second stage eleven hours. While the hand was never introduced sufficiently far into the uterus to definitely feel a contraction ring, all the evidence, i.e., extremely slow dilatation of the cervix; failure of the vertex to descend at a normal rate, though no disproportion between it and the bony birth canal could be made out; the absence of caput and marked moulding; the presence of a well defined "ridge" in the lower uterine segment palpable abdominally; and the retraction of the vertex upon relaxation of the contraction, points to this condition as the cause of her dystocia.

CASE 2.—Mrs. M. B., aged nineteen, para i, was admitted to the Brooklyn Hospital Dispensary July 10, 1930. Her date of expected confinement was computed to be January 9, 1931. Pelvimetry showed a just minor pelvis. She manifested no toxic symptoms, there was no prepartum bleeding, urine was consistently negative and blood pressure ranged from 104/50 to 120/70. At the end of the eighth month the presenting part could not be determined. She was admitted to the hospital at 11:30 A.M., January 4, 1931, with a history of rupture of the membranes four and one-half hours previously and slight bloody show, pains at fifteen to twenty minute intervals. Upon examination the fundus was found to be two fingers below the xiphoid, back left, fetal heart left lower quadrant. At 4:30 P.M. pains were every two or three minutes, fairly distressing, with good contractions. At 11:30 P.M., twelve hours after admission, vaginal examination revealed a breech in mid pelvis with the cervix soft, thin and open between three and four fingers, good progress for a primiparous breech. At 7 A.M. the breech was visible with pains. Crowning of the breech with-

out further descent continued for four hours when, after all efforts to get the fingers or a bandage around the groins failing, an unsuccessful attempt was made to push the breech up, pull the feet down and extract. It was then discovered that a strong contraction ring was firmly clamped around the baby's body. It was only after thirty minutes of deep, open mask ether anesthesia that there was sufficient relaxation of the contraction ring to allow the breech to be broken up and extracted. There was some difficulty with the shoulders, but none with the aftercoming head. The eight and one-half pound baby was stillborn, the fetal heart having been last heard just before the extraction was begun. The mother was in moderately severe shock.

CASE 3.—Mrs. J. C., aged twenty-five, para i, after an entirely uneventful prenatal course, was admitted to the Brooklyn Hospital September 25, 1925, several hours after rupture of the membranes. Active labor began at 2:30 A.M., September 26, with the vertex dipping into the brim. Pains with contractions occurred irregularly from five to fifteen minutes for twelve hours, at the end of which time a rectal examination showed the vertex still rather high, cervix edge thick and dilated to the size of a silver dollar, position not made out. On vaginal examination twenty hours after the onset of labor, the vertex was found to be entering mid pelvis, the cervix fairly thick and open between two and three fingers, position L.O.P. After thirty hours of fairly active labor and with descent of the vertex and dilatation of the cervix having remained relatively stationary for eighteen hours, it was decided to manually rotate the vertex above the pelvic inlet from L.O.P. to R.O.A. In the execution of this maneuver the presence of a stiff contraction ring was noted. Deep ether anesthesia was necessary for its relaxation and the accomplishment of the rotation. The bony pelvis was ample and the dystocia was due entirely to the contraction ring. Two hours after rotation, contractions were reestablished. These continued every ten to five to two minutes until full dilatation. Vaginal examination six hours after rotation showed the vertex to have redescended to high mid pelvis in the R.O.A. position with good flexion and the cervix three inches dilated. Approximately forty-two hours from the beginning of labor and fifteen hours after rotation, full dilatation of the cervix with the vertex on the perineum had been accomplished. The second stage was of one hour and ten minutes' duration, during which the sphincter ani was dilated, median episiotomy and forceps control were done after a good crown. Mother and baby were in good condition following delivery. The baby weighed seven pounds twelve ounces. During this long and tedious labor, narcosis and analgesia were secured by the use of sodium bromide and chloral hydrate by rectum late in the first stage. Eight doses of morphine and scopolamine were given over a period of thirty-six hours; gas-oxygen analgesia from full dilatation until complete anesthesia for delivery. A mild degree of toxemia was suggested by slight edema of the ankles and a blood pressure of 155/105 on admission and an intrapartum rise to 210/110 at one time, but was not substantiated by subsequent laboratory findings. The blood pressure did not go above 130/75 postpartum.

A résumé has been given of a case in each of the presentations and positions ordinarily encountered in the conduct of labor, in which a contraction ring of the lower uterine segment has entered as a complication sufficiently serious to greatly prolong the labor itself and endanger the life of mother and child. After many years of observation instigated by the late Dr. Pomeroy, we feel that this is a definite and not uncommon clinical entity, frequently overlooked and leading to real dystocia.

(For discussion, see page 612.)

ORAL ADMINISTRATION OF SODIUM AMYTAL IN ECLAMPSIA*

BY E. C. HAMBLIN, M.D., AND D. O. HAMBLIN, M.D., UNIVERSITY, VA.

(From the Department of Obstetrics and Gynecology, University of Virginia Hospital)

THE employment intravenously of sodium amytal in the treatment of eclampsia has been described by a number of clinicians.^{1, 2, 3} Experimental studies of its effect on liver function, secretion of urine, and alkali reserve of the blood⁴ and of its effect on the fetus⁵ have shown no contraindications to its use in eclampsia. Our results with its intravenous administration to control convulsions in twenty patients with eclampsia during the last year have been satisfactory. Oral use of sodium amytal in these cases was suggested from our experience⁶ in administering it in normal labor. We believe that the substitution of an oral method for an intravenous one is always desirable where it is possible. Oral administration of sodium amytal in eclampsia would seem to have additional advantages: (a) the drug could be given in emergencies where the intravenous technic was not feasible; (b) this fact would extend its use by the general practitioner; (c) and the result would be a decreased incidence of the use of morphine, large doses of which, we believe, materially increase fetal and maternal mortalities in eclampsia. We present the study of 6 patients† with eclampsia whose only sedation was received from the oral administration of sodium amytal.

Treatment.—The essentials in treatment of these patients have been the same in all cases. Each patient immediately after admission has received 15 to 18 gr. of sodium amytal. Only one of the 6 patients was able to take the capsules by mouth; the drug was administered to the remaining 5 by nasal catheter. Subsequent doses were administered 3 to 6 gr. at a time approximately every four hours for a period of twenty-four to thirty-six hours, indications for each dose being restlessness or a rise in blood pressure. After the administration of 30 to 45 gr., it was found that a deep sleep could be maintained by 3 gr. doses at increasingly wider intervals.

Hypertonic glucose was given intravenously to each patient in amounts sufficient to establish satisfactory diuresis and to combat any tendency toward acidosis. In Case 6, where the patient presented a low blood calcium on admission, calcium glueonate was given intravenously. As soon as the blood pressure curve had begun to decline, diuresis had been

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†Since submission of this article, our studies of eight additional patients with eclampsia, receiving only oral sodium amytal for sedation have yielded similar satisfactory results.

established, and the patient could take fluids by mouth a diet consisting of 2000 c.c. of milk with an additional 1000 c.c. of fluids other than milk was given.

Adjuvant measures included: free catharsis with magnesium sulphate; diet with maintenance protein on the sixth to seventh day; and absolute rest and quiet.

Clinical Progress.—Convulsions were controlled immediately with the initial dose of sodium amytal. There were no recurrences of convulsions as labor began or progressed or in the puerperium. In Case 1 the patient did not go into spontaneous labor until four days after the last convulsion, during which time there was marked improvement of the toxemia.

The postpartum progress of these patients was satisfactory. Diuresis was established by the end of the second day of the puerperium. Edema subsided within several days. Blood pressure gradually fell to normal levels. A rise of the blood pressure usually responded well to a slight increased dosage of sodium amytal with more complete sedation.

RESULTS

1. In all 6 patients convulsions were immediately controlled by oral administration of sodium amytal without adjuvant narcotics or sedatives.
2. After convulsions were controlled, sedation was maintained with relatively small doses of sodium amytal.
3. None of the patients exhibited the depression of respiratory rate or the cyanosis which have been observed frequently in patients receiving large doses of morphine.
4. No inhalation anesthesia was required for delivery of the patients.
5. The babies were in good condition at delivery and required no vigorous resuscitation.

CONCLUSION

We believe that it may be inferred from these 6 cases that the convulsions of eclampsia can be controlled promptly and completely by the oral administration of sodium amytal without untoward effects on the mother or baby.

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"ASCENDING" INTRAUTERINE POLYP

BY R. A. LIFVENDAHL, M.D., CHICAGO, ILL.

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THE term "ascending intrauterine polyp" is suggested to denote the upward, rather than the usual downward, growth of a polyp within the uterine cavity. In most cases these submucous tumors have been described as projecting towards the internal os, into the cervical canal, or lying free in the cavity, after spontaneous amputation. In this specimen the direction of growth has been towards the cavity, where the resistance is less as compared to the surrounding uterine musculature. As usual, the accompanying dysmenorrhea associated with attempts of the uterus to expel this "foreign body" was present in this patient.

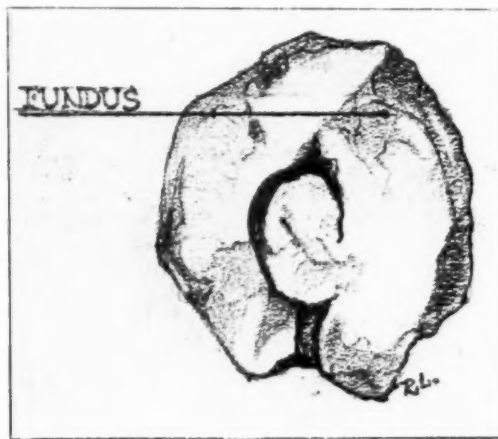


Fig. 1

CASE REPORT

White woman, aged forty-three years. Her menstruation began at fourteen, at monthly intervals, three days' duration until her marriage at twenty-six and since, four to six days, more profuse, and contained considerable clotted blood. Low abdominal cramps and a lumbar backache present on the first day. Three years and then again nineteen days before the supravaginal amputation of the uterus, the pain on the first day of menstruation was so severe that, with the accompanying periumbilical pain, abdominal distention, and inability to pass gas per rectum led to a preliminary diagnosis of intestinal obstruction, by another physician. However, after enemas, the intestinal symptoms subsided. Before operation bimanual examination revealed an old bilateral laceration of the cervix with slight ectropion of the cervical mucosa, the corpus uteri anteverted, movable, enlarged to the size of a six weeks' pregnancy, and of a hard consistency, but no distinct fibroma was palpable. The left appendages were adherent.

Examination of Specimen.—The corpus uteri measured 5 cm. longitudinally and transversely and had an anteroposterior diameter of 3.5 cm. The wall was symmetrically and uniformly thickened up to 1.8 cm. and showed no local "work-hypertrophy" although the tumor was not in a symmetrical position in relation to the direction of uterine muscular contractions. Originating 2 to 3 mm. above the internal os, on the left side, was a 1.8 by 1.2 by 1.8 submucous fibromyoma having a pedicle 1 cm. in diameter which extended upwards into the uterine cavity (Fig. 1). The surface of this fibroid was yellowish gray mottled with dark red and microscopically represents hyperplastic endometrium. Similar mucosal changes were present in the remaining endometrium except where the tumor was compressed, here the mucosa was thin and the glands were arranged in an oblique direction.

SPONTANEOUS RUPTURE OF THE UTERUS AT THREE AND ONE-HALF MONTHS' GESTATION

By ROBERT S. SMYLIE, A.B., M.D., SANTA CRUZ, CALIF.

SPONTANEOUS rupture of the uterus in young, healthy primiparae during the first four months of gestation is exceedingly rare and exceptionally few cases have been reported excluding those cases with infantile uteri.

The case reported herewith presents some unusual features both from the standpoint of history and findings at autopsy.

R. E., colored, aged nineteen, married. Admitted to the hospital Sept. 23, 1929. The history obtained was meager and difficult to elicit. Shortly after midnight of the day of admission patient was awakened from sleep by a severe abdominal pain. She was given a drink of whiskey, and a hot water bottle was applied to the abdomen without relief. Her condition gradually became more grave and a local negro physician was called who told the patient she was threatened with an abortion, and according to the statement of the husband left some medicine and took his departure.

Patient was seen at 11:00 A. M., at which time she was in profound shock with moderate rigidity of the entire abdominal wall and extreme tenderness over the entire abdomen. There was a rounded palpable mass, fluctuant, almost the size of a small adult head and extending to the level of the umbilicus.

Diagnosis of ruptured uterus was made, ambulance was called, and the patient was taken immediately to the hospital, where she died ten minutes after admission.

Autopsy revealed nothing of importance with the following exceptions. The left lung was almost completely collapsed. The right one contained only a small amount of air. Cut section showed a wet, congested surface but nothing further worthy of note. Microscopic section revealed many dilated vesicles. The abdominal cavity was distended by much blood, the amount being impossible to measure. There were many clots especially in the peritoneal recesses. Extending to the level of the umbilicus was the intact amnion containing a fetus corresponding in size to a three or four months' gestation extruding from a rupture of the uterine fundus. At the juncture of the amnion with the uterus, was much clotted blood and placental tissue. The length of the uterus from the edge of the rupture to the cervix was 16 cm. Diameter of the amniotic sac was 15 cm. Upon opening the uterus its cavity was found to be filled with clotted blood. The placenta was attached to the left lateral wall of the uterus. The adnexa were negative. Microscopic section revealed the placental units intact. Some syncytial cells were seen in a few places, and a few polymorphonuclears near some clotted blood. Section of uterine musculature at the site of rupture revealed nothing abnormal. The bronchial lymph glands were all

greatly enlarged and on section showed a black pigment and a cheesy content. Microscopic section exhibited large areas of caseation with surrounding giant and epithelioid cells. No miliary tubercles were seen.

A subsequent visit to the patient's home for the purpose of obtaining further history from the immediate family was productive of nothing further of importance other than the patient had never had any severe illness and had had no previous pregnancies. There had been no attempts at abortion during the present pregnancy. There was no history of any sort of trauma nor any account of any unusual exertion by the patient. The husband denied any venereal history in either his wife or himself.

If the patient's condition had been correctly diagnosed at the time of onset of symptoms or shortly thereafter, prompt surgical intervention would in all probability have obviated the fatal outcome.

MEDICO-DENTAL BUILDING.

INTRAPELVIC TUBAL INSUFFLATION SYRINGE*

By FRANSIS W. SOVAK, M.D., F.A.C.S., NEW YORK

(From the Gynecological Department of The University and Bellevue Hospital Medical College)

FOR the past year we have been interested in tubal reconstruction, not primarily as a problem in sterility, but with the idea of developing a technic in operations upon occluded tubes, so that they would remain patent after operation.

A preoperative salpingogram will establish the patency or nonpatency and the site of occlusion in either or both of the tubes, but it is necessary at the time of the operation to know the exact site of the occlusion or kinking of the respective tube. Also in those patients who have not had any preoperative study, it is well to know whether the tubes are patent or occluded at the time of operation.

The use of a fine probe traumatizes the tubal mucosa and frequently produces false passages. Arthur Curtis suggested the use of a small glass syringe to test the patency of the tubes intrapelvically. The use of the small syringe with the short tip and small air capacity was not very practical in all cases.

We have devised a syringe in two sizes $\frac{1}{4}$ and $\frac{1}{2}$ ounce, with a long shank having a beaded tip or a bead near its outlet. The beaded tip is nontraumatic, and the tube is rendered air-tight by gentle pressure upon it with the fingers just behind the bead. This bead also prevents the syringe from slipping out of the tubal canal. The long tip of the syringe is either straight or bent at right angles, in order that insufflation may be done in any position in which the tube may lie.

Gentle pressure is exerted upon the rubber bulb, and if the tube is patent, there is a sort of gurgling sound as the air enters the uterus, and if the uterus is held in the hand, a vibratory movement is transmitted to the fingers. If the tube is occluded or kinked the portion of the tube proximal to the occlusion will be markedly dilated as shown in the illustration. When the reconstruction operation is completed, the tube is again tested for its patency in a similar manner, thus giving us knowledge as to the success of the complete operation.

Gentle and steady pressure must be employed, as a sudden and sharp blowing up of the tube may produce an emphysema of the broad ligament. We have never seen a

*Read at a meeting of the Section on Obstetrics and Gynecology, New York Academy of Medicine, May 26, 1931.

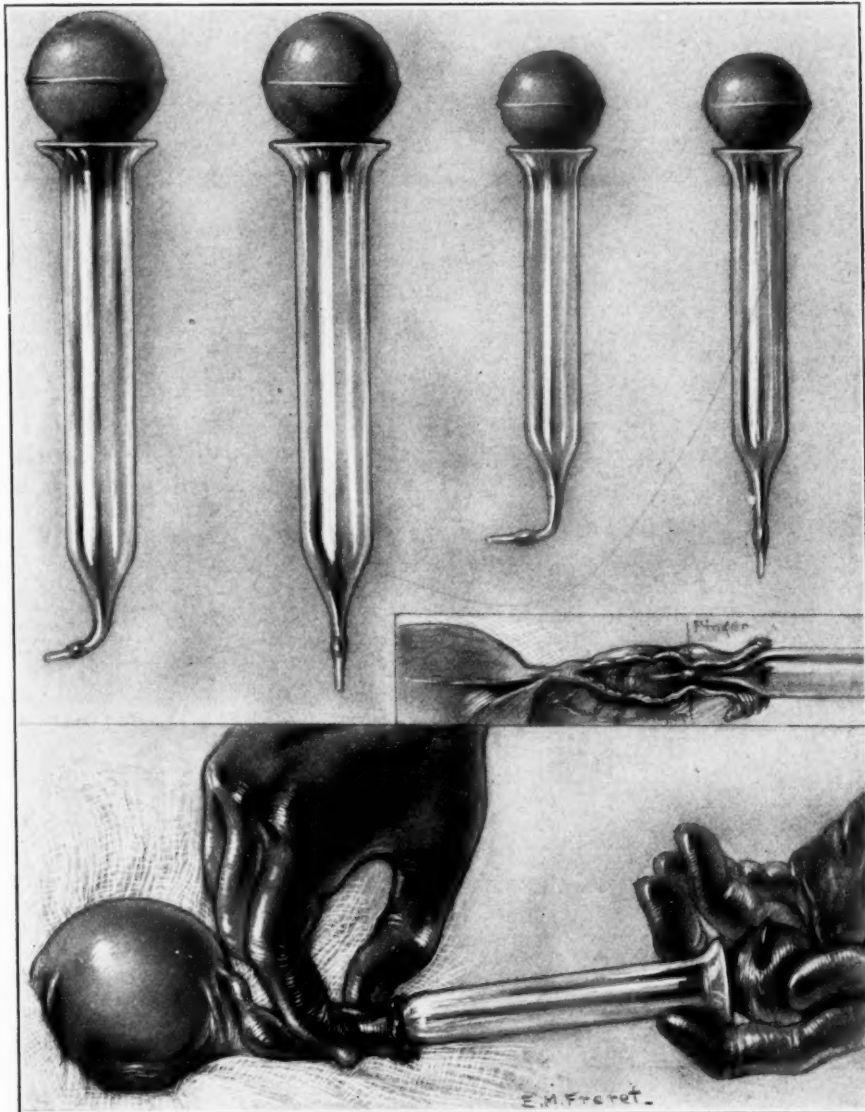


Fig. 1.

tube rupture in any other situation. This accident, however, is of no consequence, and we have not noticed any ill effect following it.

The advantages of this syringe are as follows: It is simple, inexpensive, easily sterilized, not readily breakable, and it quickly gives the operator the diagnosis of patency or nonpatency, and the site of occlusion of the tubes; does not traumatize and by forcing air into the uterine cavity, obviates any possible chance of spilling or blowing endometrial fragments into the pelvis.

I wish to thank Becton, Dickinson and Company for their kind assistance in devising this syringe.

117 EAST SEVENTY-SECOND STREET

A CLINICAL ESTIMATION OF THYTUITARY AS AN OBSTETRIC AID

By RAYMOND P. WIESEN, M.D., MILWAUKEE, WIS.

THERE are two commercial preparations of thymus-modified pituitary extract, the first to be used was a European extract marketed under the name of "Thymophysin," the second an American product marketed under the name of "Thytuitary." The later product was used in my series of 25 primiparous and 25 multiparous labors.

In the series of 25 primiparous labors, thytuitary was not given unless a primary or secondary inertia had developed. The earliest any injection was given in this series was three hours extending up to fifteen hours after the beginning of labor. The dilatation varied from 1 to 7 cm., with an average of 4 cm. (2½ fingers). In 24 of these cases the results were satisfactory. In from five to ten minutes with an average of eight minutes, there was a marked increase in the strength of the contractions as well as the frequency. In each case of this series the labor continued on to delivery in an unusually short time. The shortest time from the injection to complete dilatation was fifteen minutes, and the longest four hours and twenty minutes with the one exceptional long case of ten hours. The average time was one hour and forty minutes. The total average duration of labor in this series was ten hours and fifty-five minutes, however the average time the patient was in labor before the thytuitary was given was seven hours and fifty minutes. In none of these cases did thytuitary cause injury to the infant. The percentage of lacerations was the same as in normal deliveries. The placenta in most cases came out easily and unusually early, the earliest was one minute, the longest and adherent Duncan type placenta was forty-two minutes with an average time of nine minutes. The amount of thytuitary used was one-half cubic centimeter in all but one case.

In the series of 25 multiparous labors, thytuitary was given for either primary or secondary inertia. The earliest any injection was given in this series was thirty minutes extending up to twelve hours and forty minutes. The dilatation varies from 1 to 5 cm. with an average dilatation of 3 cm. (two fingers). The results were satisfactory in all cases. The shortest time from the injection to complete dilatation was ten minutes; the longest time was two hours, with one exception that being a persistent right occipitoposterior; the duration of labor was seven hours after the injection was given. The average for this series of multiparous labors was one hour and forty minutes. The total average duration of labor in this series of multiparous labors was seven hours and thirty-six minutes, however the average time the patient was in labor

before thytuitary was given was six hours. The average duration of the third stage was seven minutes. The amount of thytuitary used was one-half cubic centimeter, in all but three cases where 1 c.c. was used. In none of these cases did thytuitary cause injury to the infant. The percentage of lacerations was the same as in normal deliveries.

CONCLUSIONS

It is readily seen that the length of labor in the above series must not be compared with continental European experience, because obstetricians there use a similar preparation in all cases, normal as well as abnormal, at the inception of labor, to hasten dilatation. Their claims of labor usually terminating in three to four hours, are doubtless made possible by this technic, which, of course, is considered ultraradical in this country at this time.

The average elapsed time of labor in these cases, however, was reduced approximately 50 per cent from our expectancies based upon our experience with the same class and kind of cases where thytuitary was not employed.

The statement that thytuitary has a specific and first effect upon the cervical musculature seems to be substantiated by the fact that in these 50 deliveries, there was absolutely no evidence of unusual cervical injury, and yet there was a much greater muscular motility observable and a distinct acceleration of dilatation.

The statement that results parallel with those secured by the use of thytuitary may be obtained by using small doses of pituitary extract seem to be disproved. In fact in a small series of cases I have used small doses of pituitary extract in the first stage of labor and found it to be very unsatisfactory.

It is my belief that a proper and intelligent use of thytuitary will go far toward avoiding long-drawn-out labors with their concomitant surgical termination.

1348 NORTH TWENTY-SEVENTH STREET

AN ATOMIZER FOR VAGINAL ANTISEPSIS DURING LABOR AND VAGINAL MEDICATION IN GYNECOLOGIC PRACTICE

CHARLES EDWARD ZIEGLER, M.D., PITTSBURGH, PA.

OBSTETRICS is classified as surgical rather than medical practice and obstetric technic is regarded as surgical technic. And yet until recently no serious attempt has been made to sterilize the birth canal, the field of operation in obstetrics. This is in marked contrast to the procedure in other branches of surgical practice and may very well explain the persistently unfavorable results in obstetrics. The obstetrician not infrequently invades, traumatizes, and lacerates the unprepared and at times infected birth canal. The gynecologist, in contrast, routinely prepares the vaginal field. He scrubs, irrigates, and applies antiseptics to cleanse and sterilize the tissues before cutting into them.

It is more and more apparent from the rapidly accumulating evidence in the literature of the subject, that the vagina of every woman in labor must be regarded as potentially infected, in that it may contain pathogenic bacteria. In from 25 to 55 per cent of cases, dependable bacteriologic studies seem to indicate that positive cultures may be secured from the vagina after the beginning of labor. The bacteria increase with the duration of labor, with the length of time the membranes have been ruptured before delivery, with the number of vaginal examinations, and with operative deliveries.

How the bacteria reach the vagina, if they are present when labor begins, and who is responsible is not so important. But it is important that every effort be made to get rid of them, to sterilize the birth canal before the forces of labor and surgical intervention produce the inevitable abrasions, contusions, and lacerations of the infected tissues.

According to Mayes,¹ the vulva and vagina of every woman should be sterilized at the beginning of labor and as often thereafter as may be necessary to keep the parts sterile until the completion of labor. During the past five years he has sprayed the vulva and instilled into the vagina, a 4 per cent solution of mercurochrome in over 9,000 cases, with very gratifying results.

Mayes instills the mercurochrome with a glass syringe and depends upon his gloved fingers "to work it into the folds of the mucous membrane and about the cervix." Investigation of his method shows that it cannot be depended upon to apply the solution thoroughly to every part of the canal. Isolated areas are often found untouched, even after the most painstaking effort to reach them. The attempt, moreover, is frequently uncomfortable to the patient and in primiparae especially, may arouse so much resistance that the working-in process must be given up.

With the expectation that Mayes' results could be improved if the objections to his method were overcome, the author designed an atomizer for spraying the parts. Following its use with one of the dye antiseptics (mercurochrome, pyridium), it was found repeatedly on inspection, that every part of the vaginal walls and cervix was thoroughly covered and dripping wet with the solution. This atomizer has been used on a considerable series of labor cases at the Elizabeth Steel Magee Hospital in Pittsburgh. A statistical study of the results is now being made.

THE VAGINAL SPRAY IN GYNECOLOGIC TREATMENT

Certain gynecologic treatments in the form of topical applications, in the pregnant or nonpregnant woman, may be conveniently and effectually applied by means

of the vaginal atomizer. Vaginal and cervical infections, such as those resulting from the *Trichomonas vaginalis* or the leucorrhea from endocervicitis, offer indications for vaginal antiseptics. With the atomizer, thorough spraying with compressed air by the physician in his office may be supplemented to good advantage by sprays administered daily or oftener by the patient herself in her home.

In preparation for gynecologic operations, it is suggested that spraying, with whatever solution may be the operator's choice, is less traumatizing and much more effective than the usual procedures now in vogue.

The successful operation of the vacuum atomizer is dependent upon certain conditions: there must be no interference with the forceful flow of air through the tip and the air in the spray must return unhindered to the atmosphere as fast as it separates from the solution which it carries. Ordinarily these conditions can only be fulfilled when exposed surfaces or well ventilated spaces are sprayed. This explains why the use of the atomizer in medicine has been limited for the most part to the treatment of nose and throat affections and the spraying of the body

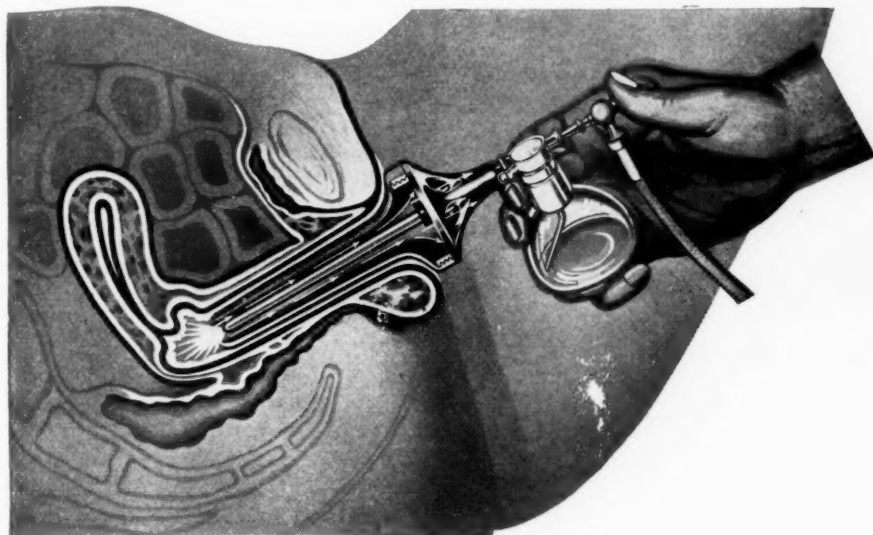


Fig. 1.—Showing the atomizer in operation with compressed air. The arrows indicate the way in which the air escapes during spraying.

surfaces, and why in its usual form it is not adapted for use in spraying a body cavity with collapsed walls and a constricted outlet, as the vagina. The canal is obliterated by the approximation of its walls and the resistance to their separation is too great to be overcome by the force of the spray. The vagina may be distended by forcing more and more air into it, but the air carries no fluid because of back pressure through the atomizer tube from the accumulation of air within the vagina.

The device here described consists of the usual atomizer, with an elongated metal tip encased by a much larger, tapering tubular tip adapted for easy insertion into the vagina. The encasing tip projects well beyond the end of the atomizer tip, to protect the opening in the latter from closure by contact with the vaginal walls and to provide a space into which the fully developed spray may be delivered without interference.

The annular space between the atomizer tip and the encasing tip communicates with the vent holes in the latter and provides for the escape of the air into the atmosphere as it separates from the liquid during spraying.

The encasing tip is made of bakelite in two parts which are screwed together, and is attached to the head of the atomizer bottle by means of a spring clip (Fig. 1). This construction makes it easy to take apart for cleaning and sterilizing. The bakelite parts may be sterilized by boiling and are not affected by chemical sterilizing agents and antiseptics.

The operation of the atomizer is simple, as illustrated in Fig. 1. The source of air pressure may be either compressed air or the atomizer bulb.

Good exposure of every part of the vaginal walls and cervix to the full force of the spray is accomplished by spraying continuously while moving the tip of the atomizer repeatedly in an inward and outward direction, deep insertion alternating with almost complete withdrawal, separating every fold and seeking out in order again and again, every section of the canal. As there is no building up of back pressure within the vagina, there is no abatement in the force and penetration of the spray.

TECHNIC.—The vulva is shaved, carefully washed with wet sterile gauze and dried. The parts are not flushed or irrigated, to prevent washing contamination into the vagina.

The sterilized bakelite tip is attached to the atomizer, the bottle of which holds an ounce, the amount of solution to be used. The external parts, including the anus, are sprayed first. The labia are then separated, the introitus sprayed, and the tip inserted into the vagina which is to be sprayed in the manner previously described. It is only necessary to remember that the spraying must proceed without interruption, as the open end of the tip, through which the spray is delivered, passes again and again over every part of the vaginal walls and cervix.

When the bottle is empty, the tip is withdrawn, the encasing tip is detached, and the external parts are dried with air forced through the atomizer. The parts are not covered after spraying.

Every woman should be sprayed at the beginning of labor and every twelve hours thereafter until the completion of labor. It is well known that infection may be concealed within the glands of the cervix and the organisms, notably gonococci, released as the glands are emptied through the ironing-out processes of dilatation and effacement of the cervix during labor. Hence, the importance of repeated sprayings with the prolongation of labor. It is especially indicated when vaginal examinations have been made and before operative interference of every kind, including cesarean section.

In hospital and office practice it is of great advantage to use compressed air because of the ease and rapidity with which the spraying is done. It is important, however, that the fluid be not delivered faster than the tissues will absorb and hold it. Perfect control may be provided by equipping the air tube with an air-pressure reducing valve.

In the home, where it is ordinarily difficult, if not impossible, to maintain asepsis during labor, the vaginal atomizer is ideal in its simplicity and effectiveness. While compressed air is not available, the atomizer bulb works just as well, even if at the expense of somewhat more time and effort.

Our experience has been limited to the use of mercurochrome, 4 per cent; pyridium, 1 per cent, and metaphen, 1:2500 solutions. They may be used freely within the vagina without ill effects to mother or baby.

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American Journal of Obstetrics and Gynecology

GEORGE W. KOSMAK, M.D., EDITOR

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Editorial Comment

HONESTY IN PUERPERAL MORTALITY RATES

HIGH puerperal mortality rates in the United States have roused great interest among actual or potential mothers and among physicians of the country. Not infrequently the arguments offered, conclusions assumed, and even acted upon, have appeared to be emotional rather than rational, and occasionally hysterical rather than critical in quality.

During the period of agitation for the passage of the Sheppard-Towner Bill the entire press of the country gave free vent to the publicity brought out by the Federal Children's Bureau in which the United States was ignominiously listed as seventeenth in rank among civilized nations on the basis of crude maternal mortality rates. Countries of which it was known that little trust could be placed on the accuracy or completeness of their vital statistics, were ranked high above the United States in their consideration for the pregnant woman.

In view of the objective of pending Congressional legislation (the Jones-Bankhead bill), it is well to be on guard lest the testimony of so-called vital statistics be again invoked for propaganda purposes, as in the past, without a reasonable interpretation of the facts.

The puerperal mortality in the United States is not creditable to our standard of material well being, to our medical and associated professions and the facilities created for their care of maternity, nor to the adequacy of publicly supported measures for the protection of public health. The evidence of an unsatisfactory condition in the United States is supposed to be strengthened by some of the arguments commonly used, which assume entire comparability in the facts of maternal mortality as assembled from published statistics of other nations.

Our maternal mortality is excessive by just so much as any preventable deaths occur in connection with pregnancy. That there are preventable factors related to patients' status, to social and intelligence levels, and to the conduct of obstetric practice, there can be no doubt.

There has been no time in our history when so much attention through responsible professional bodies has been given to the discovery and correction of the various factors within medical control which may be trusted to reduce maternal mortality in the United States. These efforts will not be abated until proved preventable causes of puerperal mortality are brought under the closest practicable control. In the meantime let us be honest with ourselves and our neighbors and recognize the errors inherent in the use of international puerperal mortality rates.

Attention may therefore be directed to the publication in the current issue of the *JOURNAL* of an authoritative article on the subject. The careful reading of this should convince one of the futility of the argument of the comparatively high mortality rate of this country as a reason for the passage of federal participating legislation, the other claims for which may be regarded as of an equally false and misleading character.

Special Article

FACTORS LEADING TO MISINTERPRETATION OF MATERNAL MORTALITY RATES

BY HAVEN EMERSON, M.D., NEW YORK, N. Y.

(Professor of Public Health Administration, Columbia University)

PREVENTABLE puerperal deaths occur throughout the world, but international comparisons based on national mortality rates are misleading, and in the present state of governmental registrations of births and deaths and the published tabulations based on them, conclusions should not be offered or opinions expressed implying relative excellence in the obstetrical, medical, or midwifery services provided for national population groups.

Among the factors responsible for the noncomparability of national mortality rates are several which, if disregarded in our calculations, permit serious injustices and obvious errors in deductions.

Reporting of births (living or still) varies greatly in completeness. Where stillbirths are added to live births (in this country commonly about 4 per cent) as the basis of a maternal death rate we may be in further error because of the great variation among the races of our nation in the frequency of stillbirths, the stillbirth rate among Negroes, for instance, being much greater than among the white races with us.

If we fail to note the number of children born in multiple births, which as a matter of experience exceed the number of confinements (twins, triplets, etc.) by about 3 per cent, we are led again into an appreciable error of calculation.

Where, as has been the case in some European countries, a birth is not reported as a living birth unless the child survives until it is baptised, which may not be for several days, the live birth basis for maternal mortality rates may be seriously distorted.

Major factors quite apart from questions of professional skill, and judgments before or at the time of confinement are, of course, the race, occupation, economic status, age at first and subsequent confinements and parity of the delivery from which death results.

Social and economic changes of unprecedented magnitude and swiftness have affected the mingling of race stocks in this country, the occupations of women prior to and during childbearing ages, the age at first confinement and the number of living and stillbirths in the average family.

It is well to consider the object of statistical expressions of maternal mortality. Are we concerned with the "cost in mothers' lives of bring-

ing into the world 1000 live-born babies''? (Woodbury: Children's Bur. Pub., No. 158.) Shall we estimate the risk of maternity in terms of deaths of women of marriageable age for every thousand pregnancies, whether these terminate in live births, stillbirths, miscarriages or abortions? Shall we express the mortality in pregnancy by the difference between the mortality among the childbearing and that of nonchildbearing women, as Lowrie has suggested? (N. Y. State Jour. Med., Oct. 1, 1931.)

As physicians we are primarily concerned with the advancement of the science and art of medicine to that point where a woman may be reasonably assured that she will not lose her life from a known preventable cause related to her pregnancy, if she puts herself under the care of a physician, whether she is delivered by the physician as a general practitioner or by an obstetrician, by licensed midwife, or by midwifery trained nurse, in hospital or in the mother's home.

As sociologists or health officers we are interested in the maintenance of a stable or slightly increasing population as the result of childbearing of married women, resulting in the birth of living and surviving children in excess of the deaths of the community, and with the lowest ratio of pregnancies to living births, and the highest survival rate of mothers.

As registration officers and statisticians our endeavor must be to obtain such complete accurate original records of births, deaths, stillbirths and perhaps ultimately of abortions and even of pregnancies, as will permit reliable comparison of maternal mortality among population groups from which evidence may be obtained which will help physicians to know all the preventable factors which determine the avoidable fraction of maternal deaths. We are concerned, moreover, with the tabulation and publication of analyses of the maternal mortality records so that governments and civil agencies dealing with health will be kept informed of the trends in death rates, and can with understanding take action in the public interest when the death rates fail to show improvement.

Among a thousand certificates of death with a puerperal cause stated, as received from the physicians at the registrar's offices of our city or state health departments, there will be about 400 in which the cause of death is stated to have been solely puerperal in character, without any contributing cause, the remaining 600 giving two or more causes of which one would be puerperal.

While the result of the use of the "International List of Causes of Death" pretty widely among the modern nations is to bring close agreement in the practice of classifying single causes of death, there is no uniformity in the procedure of the national registration offices in the matter of classifying certificates presenting multiple or joint causes of death.

Throughout the United States registrars follow closely the procedure recommended by the Bureau of the Census in its "Manual of Joint Causes of Death," in which preference is stated for the International

List number under which a death should be classified, when more than one cause is certified by the physician in attendance.

Contributory causes of deaths are of the greatest importance and their entry on the death certificate is to be encouraged where appropriate, but unless the procedure of classification of such joint cause certificates is substantially the same in other countries, much of the value of comparison in national death rates is lost.

If the 600 joint cause certificates out of an average 1000 recording maternal death, with at least one of the causes stated to be of puerperal nature, were submitted to the procedure of other countries, none of which has adopted such a complete and systematic classification practice as prevails in the United States, it would be found that while about 88 per cent of these would be charged to the puerperal cause in the United States, some countries, such as England and Norway, would probably charge only 64 per cent to a puerperal cause, only one of some sixteen countries referring a larger proportion of joint causes to the puerperal list than does the United States. In fact, in a series of typical joint cause certificates involving a puerperal element in the death, the practice of different countries would certainly vary by classifying the same certificates from 64 per cent to 97 per cent under the puerperal title, rather than under a nonpuerperal contributory cause. It must be obvious that with almost two-thirds of our puerperal death reports giving one or more contributory causes, a wholly trustworthy international comparison of maternal mortality rates must await uniformity in registration practice for joint causes of deaths. It is expected that an important advance in this direction will be made at the next Conference on International List of Causes of Death in 1939.

Quite apart from differences in registration practice and in the relative completeness of reporting births and deaths, are inequalities in the distribution of the people of the nations in rural, and in small and large urban areas, for each of which there are significantly different maternal mortality rates, those of the cities being almost uniformly higher than rural rates. Urban maternal mortality rates for both white and colored in the United States are about 60 to 75 per cent higher from puerperal septicemia and about 35 per cent higher from all puerperal causes than are rural rates. In the past thirty years the urbanization of the people of the United States and particularly of the young married people has increased at a rapid rate, probably a factor in our persistently high maternal mortality. Also while deaths are, in cities at least, reported with substantial completeness, the failure to report births even in some cities up to a million population, and within the past decade, has been found to fall short by 10 per cent or more of the true total of births, an added factor in a reported high maternal mortality rate based on total births.

Probably of all the changes in the past thirty years in the United States which has tended to develop high maternal mortality rates without implying neglect of attendance, has been the drop in the birth rate, with the inevitable increase in the number of primiparae in relation to the total pregnancies among married women, and the accompanying postponement of the age of first pregnancy, both of which factors tend to determine an increase in the maternal mortality rate.

If the maternal mortality rate per 1000 live births is 5 at twenty to twenty-four years of age of mother, it will increase to about 6 at twenty-five to twenty-nine, 7 at thirty to thirty-four and 10 at ages thirty-five to thirty-nine, increases prevailing according to age whether we deal with puerperal causes or use the rate from puerperal septicemia alone.

Similarly if we find a maternal mortality rate of 6 per 1000 first confinements, this will fall to 4 for second and to 2 for third confinements, thereafter rising to 4, 7 and 8 for fourth, fifth and seventh and eighth or later confinements. Apparently if the age of the wife at first pregnancy is over twenty-five years and she has on the average less than three children, she will run a greater hazard of maternal mortality than when the first and subsequent three or four confinements were earlier in life. In some of our northern states within the past five years one-third of all puerperal deaths have occurred among primiparae dying in their first pregnancy.

In view of the many variable factors entering into the end-result of maternal mortality rates in the modern nations, which can by no method or technic of tabulation or statistical estimates be reconciled to permit of significant comparison among the rates or their determining causes, it seems unsuitable to apply the international argument of higher rates in the United States than in other countries as a forcible reason for greater efforts at life saving here, or as evidence that the quality of medical care of the pregnant woman in the United States is of an inferior character.

The most effective type of analysis of maternal mortality is such as is undertaken by a state or city through cooperation between the health office in which maternal deaths are recorded within twenty-four hours of their occurrence, and the organized medical profession which through its obstetricians can obtain by committee or personal inquiry immediate, accurate, and complete information as to all the factors which led to the particular death under consideration.

We have the strongest possible arguments for intensive efforts to reduce the preventable factors of maternal mortality, from preliminary information that as many as two-thirds of the deaths in or from confinement in our large cities are due to causes which need not have occurred. In other words nearly two-thirds of the puerperal deaths may be found to be preventable in the United States today.

The preventable causes of maternal mortality are due in part to the injustices and inequalities of economic status of young married house-

holds, in part to the maldistribution and lack of organization of prenatal, delivery and postnatal care by obstetricians and their colleagues, the general practitioner, the midwife and still further to the application of examination and operative technic to the process of delivery by physicians more in the interest of speed of delivery and supposed comfort and convenience to the patient, than according to the physiologic needs and capacities of the mother to accomplish normal noninstrumental delivery herself.

Such studies as those now in process under the auspices of the New York Academy of Medicine in cooperation with the New York City Department of Health, including analysis of all factors bearing upon the causes of every maternal death occurring in New York City over a period of three years, will teach that particular community and its physicians more than can any statistic comparisons of more or less fallacious national mortality rates.

Husfeldt, E.: Pernicious-like Anemia During Pregnancy Due to Lead Poisoning.
Acta obst. et gynec. Scandinav. 8: 25, 1929.

The author reports a case of pernicious-like anemia in pregnancy which was due to lead poisoning, the result of taking red oxide of lead as an abortifacient.

J. P. GREENHILL.

Daly, P. A.: Heart Disease in Pregnancy. *Illinois M. J.* 57: 205, 1930.

In the management of heart disease in pregnancy the condition to be avoided is heart failure. If decompensation does not occur during the prenatal state it seldom occurs during labor (less than 1 per cent at the Chicago Lying-In Hospital). Measures that can be used to prevent decompensation are regulation of voluntary work, proper rest, and the judicious use of digitalis if necessary. Early and constant observation is important, as well that delivery be made as easy as possible. Where the heart condition contraindicates future pregnancies cesarean section with ligation of the tubes is advocated.

FRANK SPIELMAN.

Society Transactions

CHICAGO GYNECOLOGICAL SOCIETY

STATED MEETING MAY 15, 1931

DR. LOUIS RUDOLPH presented a paper entitled **The Importance of Posture of the Cardiopath During Pregnancy and Labor.** (See page 546.)

ABSTRACT OF DISCUSSION

DR. DAVID HORNER.—Cardiopaths are notorious for the ease with which they deliver and always assume the most natural position for themselves. If left alone, the chances are with proper digitalization they will be able to go through the pregnancy, the labor beginning spontaneously and the expulsive effort being quite short. Only when decompensated do they require head elevation. If episiotomy is required it can be done under local anesthesia, maintaining Dr. Rudolph's reverse Trendelenburg. If there is an obstetric complication, which would require an extensive operation, one is almost compelled to give a general anesthetic. Ethylene in upright posture is least harmful of all, though I understand anesthetists like to give ether to the cardiopath.

DR. C. E. GALLOWAY.—In my experience at least these cardiac cases do better if you do not administer any pituitrin. We had five cases in which pituitrin seemed to be the offending factor in the case right after delivery. It has been thought that in the ampules once in a while there is a certain amount of histamine.

DR. RUDOLPH (closing).—Why do cardiopaths with or without cardiac failure feel better sitting up? The cardiorespiratory system is so correlated that a disturbance of the flow of blood to the heart will increase the work of the heart. The flow of blood from the splanchnic area and the upper extremities and the head is regulated by the so-called aspiratory action of the thorax. Keith has shown that with each respiration about 400 to 500 c.c. of blood flows to the right side of the heart. If the posture of the pregnant patient in labor due to the enlarged uterus interferes with the function of respiration, and the aspiratory function of the thorax is decreased, it means that less blood is being pumped into the right side of the heart. The heart rate therefore is increased and the volume of blood to the heart is decreased which causes an increased work or an extra strain on the heart. In the cardiopath the principle involved is to give the heart as little extra strain as possible, and I feel convinced that this mechanical factor is important and is one that we can control.

The problem of dilatation of the heart is one of cardiology. From a study of the physiology of cardiac failure in the cardiopath during labor, we know that the flow of blood to the heart is decreased, so that the chambers of the heart will decrease in size to accommodate themselves to the diminished volume, and at the same time there is an engorgement of the splanchnic blood. It has been stated that dilatation of the heart is a postmortem finding in all cases of cardiac death, that it is not the anemia of the heart, but an anemia of the coronary vessels that is the cause of shock and death in the cardiopath in labor or shortly after. It is necessary for obstetricians to change their terminology as to the mechanism of death in the cardiopath.

Dr. Horner advocates cesarean section. It is still an unsettled question. The problem is, what is the effect of a laparotomy on the heart, even in a low cervical

section? Henderson has called attention to the atony that occurs postoperatively which predisposes to surgical shock. In cesarean section the problem is to determine the amount of cardiac reserve. I have shown that it cannot be done with any degree of accuracy. Many cardiopaths develop cardiac failure during labor, and after the child is delivered. I do not believe that for the sake of sterilization cesarean section should be the choice in cardiopaths, as the sterilization at a later date gives the patient a better chance. I am a strong advocate of delivery per vaginam.

Dr. Galloway referred to the use of pituitrin. I believe that most cardiac deaths are due to gravity shock which means a splanchnic engorgement. The use of pituitrin helps to increase the blood pressure and increase the tone of the splanchnic vessels which will help to increase the flow of blood to the right side of the heart. It is a question whether there is enough histamine in one, two or even three ampules of pituitrin to get a histamine reaction.

DR. HARRY O. MARYAN presented a paper entitled **The Bacteriology and Pathology of Chronic Cervicitis**. (See page 555.)

DR. RICHARD TORPIN (by invitation) presented a paper entitled **Placenta Circumvallata and the Theory of Its Formation**. (See page 551.)

DISCUSSION

PROFESSOR GEORGE W. BARTELMIZ.—The question of placental growth is a problem that is worth extensive study. In the absence of adequate landmarks it has been impossible to evaluate the parts played respectively by growth and by the burrowing of the ovum into the mucous membrane at the margins of the placenta during the earlier months of pregnancy. At the middle of pregnancy the placenta occupies a relatively larger area of the uterus than at term. Dr. Torpin's theory regarding the mode of formation of the placenta circumvallata is similar to that of Grosser, but was reached independently. A detailed study of the placental margin in a large series of placentae in situ is clearly indicated.

DR. CAREY CULBERTSON.—There is no doubt that this formation represents an infarction and there is no doubt that some infarctions have been shown to be due to obliteration of the chorionic vessels secondary to some general toxemia.

The theory here presented is a mechanistic one, not based upon any pathology in the individual. It also brings out a new idea that infarction may originate in the intervillous circulation instead of in the chorionic vessels. As the gestation sac grows, the uterus accommodates itself to this growth and development. This requires an adjustment of relationship that ordinarily makes the normal placenta comparable to the demands of the normal gestation sac, the fetus and its contents. When this nicety of adjustment is lacking, we may have the conditions that Dr. Torpin has so painstakingly attempted to reproduce in his charts. We should not forget also that the character of the decidua depends upon the character of the mucosa. If this is defective, again we may have conditions such as described. The difficulty, of course, is in the proving. I suppose the best way to prove this or to attempt to prove it would be to have a large number of pregnant uteri for study.

DR. EMIL RIES.—Part of the work that Dr. Torpin mentioned was done under my guidance about forty years ago when I was an assistant at the Strassburg clinic. The question and recognition of the site of the placenta and the way the round ligaments are inserted into the uterus were investigated at that time. It was noticed that sometimes the round ligaments would be pulled in front of the uterus, at other times at the side running almost parallel in an almost vertical direction. In these

latter cases we assumed that the placenta was located in front and, therefore, had separated the points of insertion of the round ligaments. The basis of all this theorizing was that it was assumed that where the placenta grew, the uterus had to grow with it. We then proceeded to test this theory by manual exploration of the uterus after expulsion of the placenta. The theory proved about 95 per cent correct. There were still 5 per cent of the cases which for some reason or other we did not diagnose correctly. The practical value of such a method of diagnosing the site of the placenta on the uterus lay in the fact that at cesarean section, it is not desirable to cut through the placenta. At least, if a way could be found to diagnose the site of the placenta before operation, the operator could be prepared for disturbances at the site of the placenta. This investigation was carried out by Dr. Palm under the direction of Prof. Heinrich Bayer, the author of one of the best works on the pregnant uterus. Professor Bayer was very much interested in these investigations because they led up to some theories of his as to the origin of the circumvallata. His idea had been that there must have been some reason for the placenta to grow out at the edges instead of growing on the flat. He had investigated many cases of circumvallata by manual exploration after expulsion of the placenta and found them located in the uterine horns. Bayer had a theory that the uterine horn as much as the lower uterine segment undergoes invasion by the placenta if the placenta happens to be located in it. With the tubal segment being thinned, the blood supply of the placenta would suffer and, therefore, the placenta was forced to grow out. There would be a deep process of the placental tissue in the tubal segment, but this deep invasion would be insufficient to nourish the placenta. It is a question whether we always have to deal with deficient blood supply if there is insertion in an unfavorable position. That would have to be investigated by studying placenta previa. Placenta previa invading the lower segment would be acting as an annular placenta which at certain places would have a tendency to form circumvallata. The same would apply to tubal horn placenta.

DR. TORPIN (closing).—In regard to Dr. Ries' suggestion, I have made no such investigation because I have not the material. I speculated as to the cause of these bodies that normally grow on the anteroposterior wall. The marginalis occurs at the lateral angle of the uterus and the circumvallata in the horn, breaking the blood supply to the decidua all around, so the chorionic villi grew into the decidua well supplied with blood. On the lateral surface the chorionic villi would grow into anemic areas, whereas in an area like this they would grow into an area in the horn better supplied with or still containing blood.

BROOKLYN GYNECOLOGICAL SOCIETY

STATED MEETING, MAY 1, 1931

DR. J. T. WALLACE (by invitation) presented a paper entitled **Dystocia Due to Contraction Rings of the Lower Uterine Segment**. (For original article see page 589.)

DISCUSSION

DR. ELIOT BISHOP.—I feel very strongly that this type of dystocia should be treated conservatively. Patience, free use of analgesia, rotation of the posterior position 180 degrees, breaking up of a breech, the two latter to be done at the proper time and with deep anesthesia, will produce, in most instances, a live baby and an unterrified and undamaged mother. I admit the occasional loss of a baby by this method. With a young primipara, I consider it the proper practice, but

with an elderly primipara, I feel that, with the lessening years of fertility, cesarean section is indicated in the interests of the so-called "overvaluable child."

DR. CAMERON DUNCAN.—Adrenalin will sometimes relax a contraction ring. I have had occasion to put on the forceps and not get any result and after a hypodermic of 15 minims of adrenalin the contraction ring would melt away and the baby would float out with the first pull. I believe it has some relaxing effect on contraction ring in the uterus. Chloroform anesthesia sometimes will cause relaxation of a contraction ring when ether will not.

DR. H. S. ACKEN presented a **Report of 535 Consecutive Cases of Mid and High Forceps.** (For original article see page 538.)

DISCUSSION

DR. H. W. MAYES.—The use of high forceps has often been condemned, and Beck binder, version or cesarean section recommended in its place. To my mind, these all have their place, but there are undoubtedly certain cases which could be delivered, even though the presenting part does not enter the pelvis, as is illustrated in the following case report.

Mrs. J. A., a white, Italian woman, aged twenty-six, was first delivered by me in 1924. She had a mitral stenosis, heart on the verge of decompensation. Her diagonal conjugate was $10\frac{1}{2}$ cm., with a true of $8\frac{1}{2}$ cm. She was in labor for thirty hours, the breech presenting, and it was finally necessary to deliver her by breech extraction. The baby was small, weighing only 6 pounds.

Patient was again delivered in 1925. At this time she was in labor for fifteen hours, and in order to hasten dilatation of the cervix, a bag induction was done. When the cervix was fully dilated, the head was only dipping in the brim and because of her cardiac condition, an attempt was made to deliver her by high forceps. This was unsuccessful. A version was done and the baby delivered with considerable difficulty. The baby weighed 8 pounds 14 ounces.

This patient was again admitted to the hospital in 1927 and after laboring for nine hours, dilatation was assisted by means of a Voorhees bag. The presenting part finally reached the mid pelvis in an L.O.A. position and delivery was completed with Barton forceps. The baby weighed 7 pounds 2 ounces.

In 1928, after the patient had been in labor for ten and one-half hours, the cervix was fully dilated, head in L.O.T., not engaged, posterior parietal presentation. By the use of a "broken" blade of a Barton forceps, pressure was made during a contraction and the head dropped to mid pelvis. Delivery was easily completed with a Simpson forceps. The baby weighed 8 pounds 11 ounces.

In 1930, after this patient had been in labor for nine and one-half hours, the head was not engaged. An unsuccessful attempt was made to deliver by means of Barton forceps. Delivery was finally completed with a brow-mastoid application of a Tarnier axis-traction forceps. The baby weighed 8 pounds 2 ounces.

Thus, a woman with a mitral stenosis, a heart barely compensating, has been delivered by me five times in the last six years, with an average duration of labor of fifteen hours, and only once did the presenting part engage; the first a breech, the second a forceps followed by a version, the third a mid forceps, and the last two, high forceps. All babies were born alive and left the hospital in good condition. The questions may be asked: Should she have been sectioned or should she have been given a longer test of labor? I believe, with her cardiac condition and each time knowing what had happened at the previous delivery, that interference was justified in each instance. When we have a borderline pelvis, with a heart badly damaged, the use of high forceps may be the means of helping both the mother and child. High forceps does not necessarily mean the use of Tarnier axis-traction

forceps, with the handles locked like a cranioclast, for frequently the high arrest may be due to a malposition. When this is overcome, the delivery is easy. I have used Barton forceps with great satisfaction, sometimes only the broken blade to force the head into the mid pelvis. If delivery is not easily accomplished with this instrument, frequently a manual rotation may be used before the application of another forceps.

In certain patients with normal measurements and a normal size child, the rapid completion of delivery may be indicated because of the condition of the child or its mother. Then again there are undoubtedly a large number of cases which are delivered by cesarean section simply because of the danger of infection. There are those who even hesitate to do a vaginal examination in order to determine the actual condition. With proper vaginal antisepsis and a routine instillation of mereurochrome during labor, we have proved that a test of labor does little to increase the morbidity following cesarean section and I am convinced that a large number of these women could be anesthetized and delivery attempted from below by means of forceps and if a disproportion is found, then cesarean section could be performed with little risk of infection.

Correspondence

The Effect of Urinary Preservative on the Accuracy of the Aschheim-Zondek Test

TO THE EDITOR.

SIR:—Since the introduction of the Aschheim-Zondek test, many reports have appeared in the literature acclaiming its diagnostic accuracy. Freshly voided or catheterized urine is used in performing the test. This procedure can easily be carried out in the larger cities or where there is immediate access to a laboratory equipped to perform the test. I have made an investigation to determine whether the test could be performed and accurate results obtained with a sample of urine voided several days prior to its use. A number of tests were done using urine which had been left standing at room temperature for several days, with and without the addition of a preservative. The preservative where used was added immediately on obtaining the specimen of urine. In all, twelve examinations were made on nine patients. Seven of these patients were definitely pregnant. Seven examinations were made with urine containing toluene as a preservative and left standing at room temperature for a period varying from three to seven days before being used. Six of these were positive. One specimen in a patient with an amenorrhea of seven weeks, and presumably pregnant, was negative. Two examinations were made with urine which had been standing on ice for several days before use. Both of these examinations were positive. Three examinations were made with urine standing at room temperature for one week before use. In these cases all the mice died.

While it is true that from so few observations one is unable to draw any final conclusions, yet the uniformity of the positive Aschheim-Zondek test results using urine containing a preservative, points to the feasibility of securing accurate results when performing the test. This fact will be of distinct benefit to physicians in communities where facilities for doing the test are not available. It will enable them to send specimens to distant laboratories, with the assurance of receiving accurate reports.

The addition of preservative also might be useful in collecting sufficient urine so that the anterior pituitary hormone could be extracted therefrom commercially.

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Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

Selected Abstracts

Physiology of Pregnancy

Tullio: The Urinary P_{H} in Pregnancy and the Puerperium. *Osp. maggiore di Novara* 8: 756, 1930.

In a study of the urine of 80 cases of normal pregnancy and 50 cases of normal puerperium, the following results were obtained:

In pregnancy the P_{H} is 6.4, in the puerperium it is 6.2. Controls (not menstruating) show a P_{H} of 5.7, and controls (menstruating), of 6.45.

It is evident from these cases that during pregnancy there is a slight diminution of the hydrogen concentration of the urine. This might lead one to think that the kidney, an important organ in the acid-base equilibrium, might be slightly altered in function. This together with other factors, such as excretion of phosphates and NH_3 , may vary the urinary P_{H} .

Diminished urinary acidity might be the result of pulmonary supraventilation in pregnancy.

SYDNEY S. SCHOCHET.

JULIUS E. LACKNER.

Adler, M.: Calcium Content of the Blood Serum During Pregnancy. *Arch. f. Gynäk.* 143: 236, 1930.

The author studied the calcium content of the blood serum in 14 nonpregnant and 26 healthy pregnant women, in 5 women during labor, and in 12 puerperae. The Kramer-Tisdall technic was used. She found that the quantity of calcium in the serum begins to decrease during the third month of pregnancy and that from the fifth to the ninth month this decrease is both uniform and constant. During the tenth month there is a slight increase over the amount present in the ninth month. This amount, however, is still far below that found in the nonpregnant state. During labor the calcium content increases rapidly until it is well within the limits of normal physiologic variability. Within twenty-four to forty-eight hours postpartum the calcium content drops to less than was present before the onset of labor. It remains subnormal for approximately eight days, and then gradually returns to within normal limits.

RALPH A. REIS.

Cantarow, Montgomery and Bolton: The Calcium Partitioning in Pregnancy, Parturition and the Toxemias. *Surg. Gynec. Obst.* 51: 469, 1930.

This paper offers first a brief survey of the studies of calcium metabolism in pregnancy to be found in literature, secondly, a consideration of present-day views of biologists as to the chemical nature and physiologic importance of calcium in the human economy; and thirdly, a presentation of findings in a group of pregnant and parturient women, based upon these more recent biologic concepts. During the course of normal pregnancy and early labor there is a gradual diminution of total

serum calcium, a slight increase in diffusible calcium and a marked decrease in nondiffusible calcium. The ratio of diffusible to nondiffusible calcium increases steadily, reaching a maximum in the first stage of labor. This disturbance is identical with that present in bronchial asthma and allied disorders.

The toxemias of pregnancy are characterized by a marked decrease in the ratio of diffusible to nondiffusible calcium, due in most instances to an increase in the nondiffusible fraction. This finding suggests the presence of a state of diminished cell permeability, a condition which might well be associated with the marked disturbance of function that occurs in various organs in the toxemias of pregnancy.

WM. C. HENSKE.

Damble, K.: Calcium Content, Leucocytes, and Blood Coagulation in Pregnancy, Postpartum and Puerperium. Arch. f. Gynäk. 140: 313, 1930.

The normal calcium content of the blood was found to be 9.97 mg. per 100 c.c. During the second half of pregnancy this decreases to 9.36 mg. Two hours postpartum the calcium content has risen to 9.75 mg.; there is then a gradual return to the normal during the puerperium, the average reading on the fifth day being 9.82 mg. The average leucocyte count during the second half of pregnancy was 6,955 in normal healthy women, the highest normal reading being 9,822. The leucocyte counts two hours postpartum ranged from 9120 to 22,700; following this there was a gradual decrease until the fifth day when the average count was 7702. The differential count shows a shift to the left during the second half of pregnancy, with an increase of neutrophiles, nucleated erythrocytes and immature red blood cells and a decrease in lymphocytes and eosinophiles. Two hours after delivery the swing to the left is more marked as evidenced by marked increase in nucleated red blood cells and in immature red cells and a decrease in all other types of cells. By the fifth day, provided the puerperium is normal and afebrile, the differential count has returned to normal. Studies of the coagulation time in normal women showed values of five minutes for beginning of coagulation and eight minutes for the completion of coagulation. During the second half of pregnancy, the coagulation time rate increases, the rate being four and seven minutes. This increased speed of coagulation is still found two hours postpartum and on the fifth day postpartum, the rate has returned to normal. The author could establish no definite relationship between calcium content and coagulation time, calcium content and leucocyte count, or coagulation and leucocyte count.

RALPH A. REIS.

Krane, W.: Interchange of Potassium and Calcium Between Mother and Fetus. Ztschr. f. Geburtsh. u. Gynäk. 97: 22, 1930.

Krane studied the potassium and calcium content of the blood of 17 women and their children (immediately after delivery). His conclusions are: (1) The placenta does not play an active part in the passage of these salts from mother to fetus.

(2) The differences found between the concentration of potassium and calcium in the maternal and fetal sera can be explained on purely physiochemic processes.

LESTER E. FRANKENTHAL, JR.

Rupp, Hans: Sodium Chloride Metabolism During Pregnancy. Ztschr. f. Geburtsh. u. Gynäk. 95: 383, 1929.

The author examined the sodium chloride metabolism in normal healthy women, in normal pregnant women, in pregnant women during the development of edema, and in pregnant women during the subsidence of the edema. Determination of the blood and urine sodium chloride were made to see how long the salt remained in the

body after its ingestion. Comparing the curve of the blood sodium chloride with the table of the urinary secretion of this salt, the following was observed: (1) the blood sodium chloride in healthy pregnant women was increased; (2) in edematous pregnant woman the sodium chloride passes directly from the blood to the tissues and is held there; (3) during the subsidence of the edema the reverse is true. On these observations, Rupp feels that a limitation of the sodium chloride intake is the essential thing, and that limitation of fluids is not important.

LESTER E. FRANKENTHAL, JR.

Breda, Leo: Studies on Hyperbilirubinemia in Normal Pregnant Serum. *Ztschr. f. Geburtsh. u. Gynäk.* 95: 394, 1929.

The normal bilirubin content of the blood of nonpregnant women is 0.2 to 0.3 mg. per 100 c.c., and in men 0.45 to 0.55 mg. per 100 c.c. In a study of the blood of 58 pregnant women the author found that 45 per cent of the pregnant women and 20 per cent of the puerperal women (first eight days) showed an increase of bilirubin content of the blood of over 0.3 mg. per 100 c.c. These women all had negative direct van de Berger reactions. Breda feels that the hyperbilirubinemia during pregnancy is due to an altering of the bilirubinogenic apparatus, the reticulo-endothelial system, and the liver cells. These findings do not justify the term "liver of pregnancy."

LESTER E. FRANKENTHAL, JR.

Vogt, E.: Reform of the Diet in Pregnancy, With Special Consideration of the Vitamin Requirements of the Fetus. *München. med. Wehnschr.* 76: 1959, 1929.

Vogt cites various experiments to show the importance of the different vitamins to the growing fetus. He makes a special effort to meet these needs in the diet suggested for pregnant women. Emphasis is laid upon large amounts of green vegetables, fruit, eggs, milk, and milk products. In addition, cod liver oil, yeast, and vigantal (viosterol) are given in moderate dosage during the latter half of pregnancy. They are not usually given during the first half of pregnancy because of the gastric symptoms commonly encountered at this time. In addition to these vitamin-bearing substances, some form of calcium is usually administered. The author feels that habitual abortion or premature labor, habitual death of the fetus at term, and the manifestations of eclampsia are all indications for the inclusion of large amounts of vitamins A, B, C, and D in the pregnancy diet.

A. SHULMAN.

Nahmmacher, H. How Does Standardized Vitamin D (Vigantal) Administered to the Pregnant Woman Influence the Development of the Fetal Organism and the Pregnancy? *Zentralbl. f. Gynäk.* 54: 1820, 1930.

In order to determine the effect of a standard vitamin D, the trade preparation Vigantal was used. Observations were made on 45 pregnant women who worked in the hospital while waiting for confinement; 79 similar cases were taken from the records of the years 1926-28 as controls. The observations were as follows: (1) Increased drop in initial weight loss of the newborn (due to increased metabolism?); (2) physiologic initial weight loss is further influenced as follows; (a) uninfluenced by 80 mg. of vigantal, (b) markedly increased by 300 clinical units. (3) A slight increase in birth weight in only a very few cases. (4) A tendency to lengthening of the pregnancy, average being ten days. (5) The addition of cod liver oil to the diet during pregnancy not only prevents habitual antepartum death of the fetus, but greatly aids intrauterine development.

WILLIAM F. MENGERT.

Temesvary, N.: Diseases of the Teeth and Pregnancy. *Monatschr. f. Geburtsh. u. Gynäk.* 87: 527, 1931.

Afflictions of the teeth which affect pregnant women are gingivitis, especially gingivitis hypertrophica, caries, toothache, epulis, loosening of the teeth and periostitis. Etiologic factors are improper nourishment, digestive disturbances, frequent vomiting, with acidification of the saliva, lack of care of the mouth and teeth and changes in the calcium metabolism and of other salts. In many cases, the cause is a disturbance in the balance of the glands of internal secretion. Toothaches and changes in the calcium structure of the teeth are almost certainly due to hormonal influences. Changes in the teeth usually appear in the fourth month of gestation and continue until six or eight weeks after delivery. Prophylaxis consists of proper care of the teeth and mouth during pregnancy. The teeth should be examined every two or three months during pregnancy. Treatment of the teeth may safely be undertaken in a pregnant woman because no harm has ever been observed. It is wise however, to avoid energetic manipulation four, eight, and twelve weeks after the last menses because of the greater tendency to abortion in the first three months of pregnancy.

The author mentions that as an important prophylactic measure against puerperal infection the teeth not only of the pregnant women should be carefully controlled but also teeth and mouths of all persons who take care of the patients.

J. P. GREENHILL.

Item

The American Board of Obstetrics and Gynecology

The general examination of the American Board of Obstetrics and Gynecology will be held Tuesday, May 10, 1932, at New Orleans.—Secretary, Dr. Paul Titus, 1015 Highland Building, Pittsburgh, Pa.